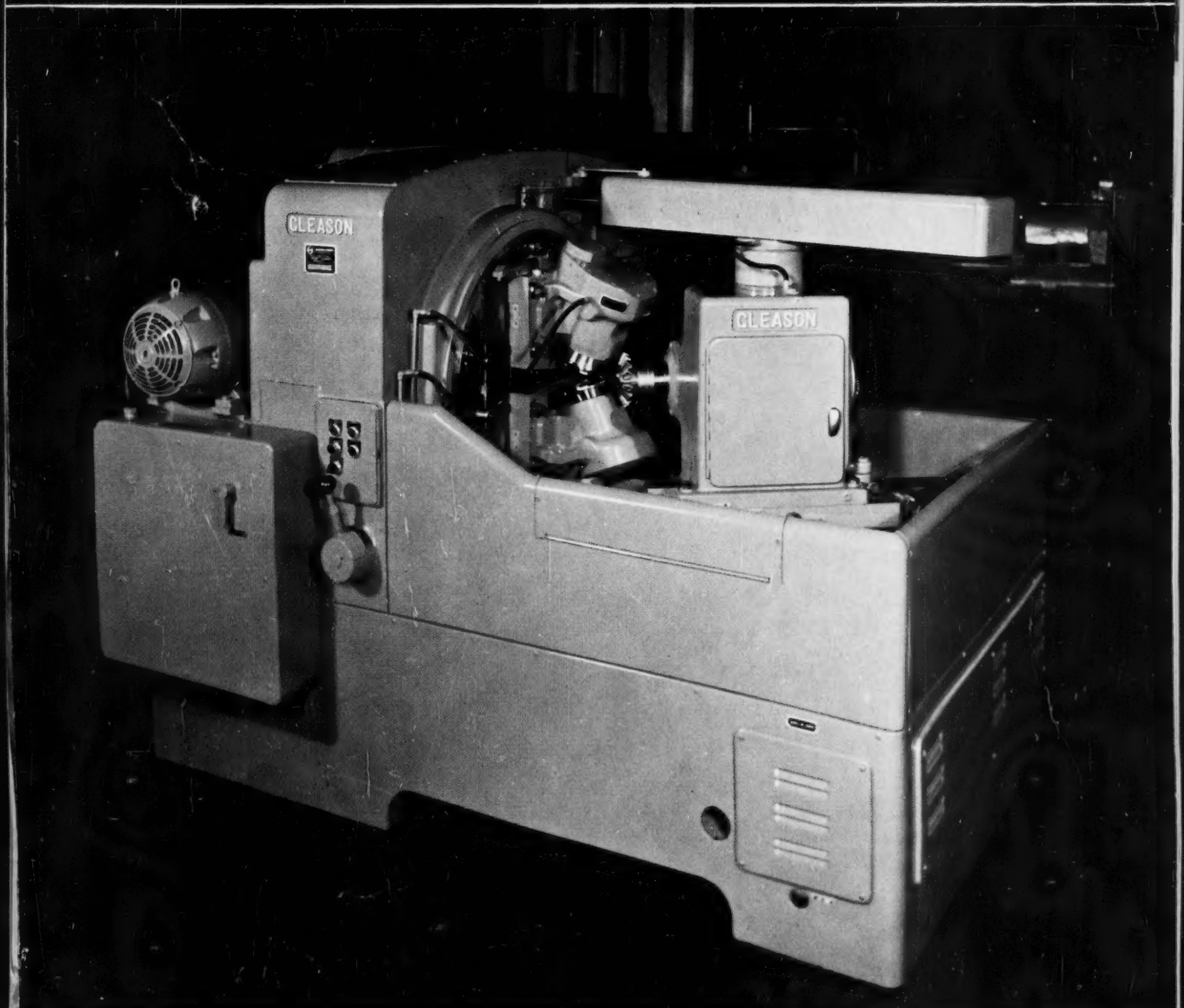
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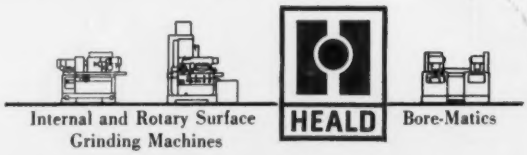
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VOLUME 61 SEPTEMBER, 1954 NUMBER 1

The Monthly Magazine of Engineering and Production in the Manufacture of Metal Products

SHOP PRACTICE

Span Measurement of Involute Gear Teeth .. *By J. E. Van Acker* 153
Loading Devices Speed Gear-Shaving Production .. *By T. S. Gates* 163
Bolt Cold-Heading and Inspection at International Harvester *By J. P. Lehning* 171
Brass Wheels Grind Carbides *By Arthur A. Merry and Leslie F. Wheeler* 174
14,000-Ton Press Produces Big Extrusions 178
Lacquer Hot-Sprayed on Machine Tools 184
Cotton Picker Spindles Require Some Unusual Operations *By W. P. Gronke* 187
Miniature Machines Drill and Insert Small Pins 190
Multiple-Spindle Automatics Now 100 Per Cent Carbide-Tooled *By George Sundell* 192
Low-Cost Press Tools for Moderate Production Requirements *By G. C. Matson* 196
Conservation of Diamond Wheels 198
Special Card Expedites Drilling Set-Ups ..... *By Herbert Chase* 199

MACHINE AND TOOL DESIGN

Standardization of Minimum Bend Radii for Sheet Metal *By Bernhard Rogge* 200
Five Hundred Dollars in Prizes for Articles on Ingenious Mechanisms 202
Reciprocating Cam with Half-Cycle Dwell ..... *By L. Kasper* 203
Safety Devices Protect Slides Against Overloads *By W. M. Halliday* 204
Accurate Depth Stop Integral with Drill Socket *By Roger Isetts* 206
Storage Rack Keeps Nuts Properly Assorted .. *By W. M. Halliday* 206
Quick Method for Setting Lathe Tool at Center Line of Spindle *By Stanley P. Gould* 207
Calculating Dimensions of a Cone Frustrum for a Given Volume *By William Rosenberg* 208
Wrought Aluminum Alloy Designation Conversions (Data Sheet) 255

MANAGEMENT PROBLEMS

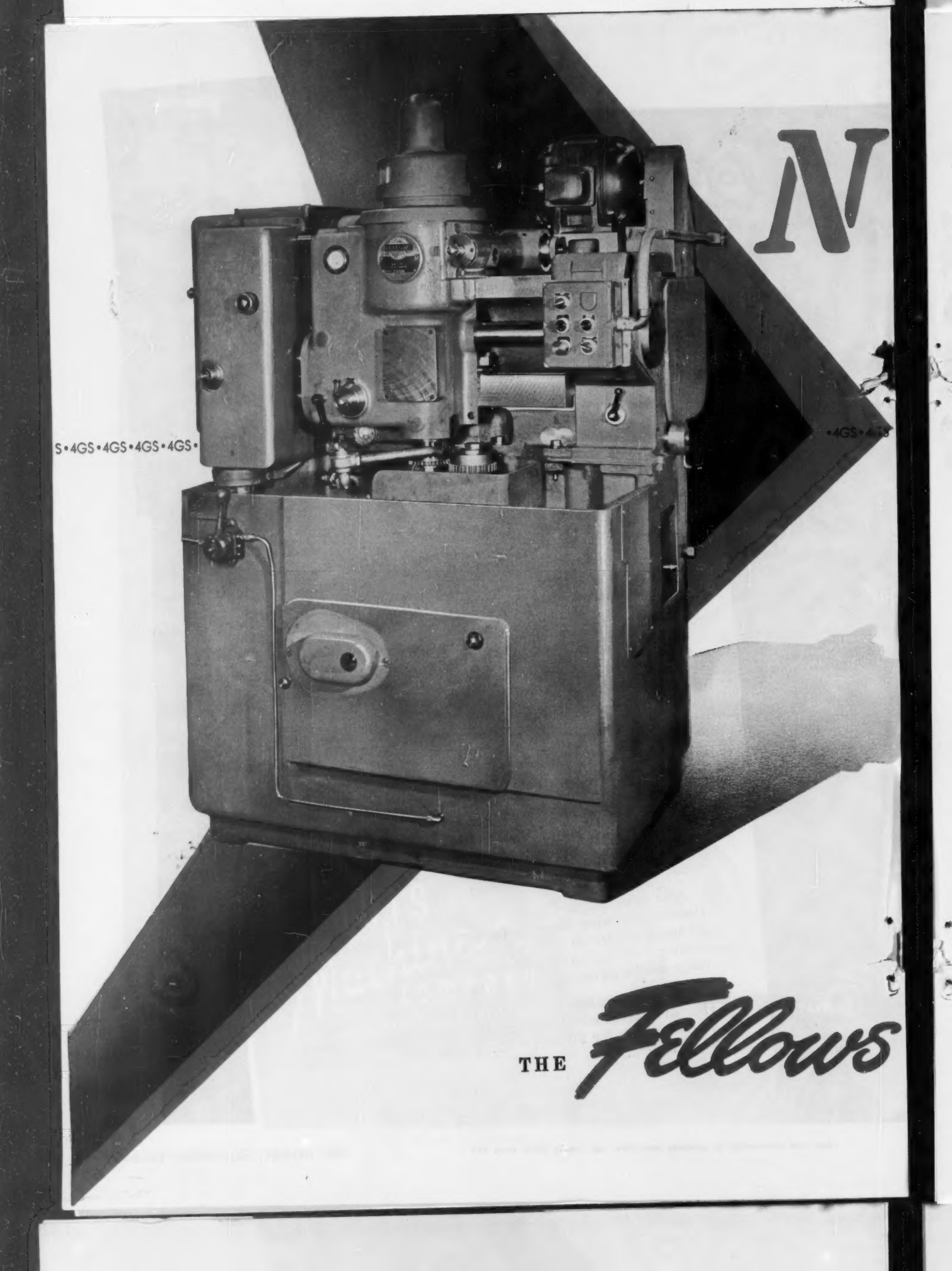
Defense Productive Equipment Requirements to be Reappraised *By Loring F. Overman* 149
How Many Physically Handicapped Does Your Plant Employ? *By Charles O. Herb* 151
Offensive Versus Defensive Selling ..... *By Bernard Lester* 209

DEPARTMENTS

Keeping up with Washington 149
Materials of Industry 181
In Shops Around the Country 194
Ingenious Mechanisms 203
Ideas for Shop and Drafting-Room 206
The Sales Engineer 209
The Latest in Shop Equipment 210
New Catalogues 243
Between Grinds 249
News of the Industry 250
Data Sheet 255
Coming Events 260
New Books and Publications 262

Product Directory 296

Advertisers Index 413–414


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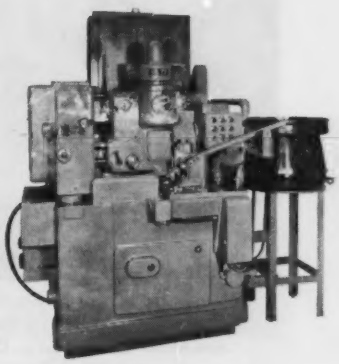
● This, the all-new No. 4GS Gear Shaper, will (1) remove more stock, (2) hold to limits more easily, and (3) turn out finish-cut or preshave gears faster than anything you've known.

● It's a production man's Gear Shaper—with a drive-mechanism beefed up to match its 3⅜ inch diameter cutter spindle which takes 4 inch cutters. Speeds from 98 to 635 strokes per minute are available through pick-off gears.

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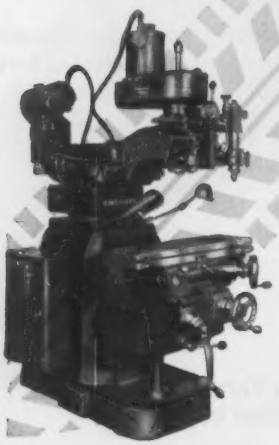
...and you may find a good idea in this rubber mold setup



Meticulous, demanding die sinking operations are transformed to automatic, carefree operations with the Power Driven Duplex Rotary Table Attachment mounted on a CINCINNATI 8" x 18" Tool and Die Miller.

Notice how the cutter spindle and tracing head of the CINCINNATI 8" x 18" Tool and Die Miller at the right are swiveled to the most advantageous tracing and cutting position. The head can be swiveled right and left, forward and back, around a pivot approximately at the end of the cutter. Does this give you an idea? Notice the extra large cutting range evident from this setup; it's actually 8" x 18" in one setting. Does this give you an idea? Notice the power driven Duplex Rotary Table Attachment; it rotates the master and work (mold) at the same speed under the cutter and tracing finger. Does this give you an idea? There are many exclusive advantages of the CINCINNATI 8" x 18" Tool and Die Miller that you can translate into useful and profitable ideas for producing dies and molds, and for toolroom milling. Brief data on these machines will be found in Sweet's Machine Tool Catalog; complete information may be obtained by writing for catalog No. M-1731.

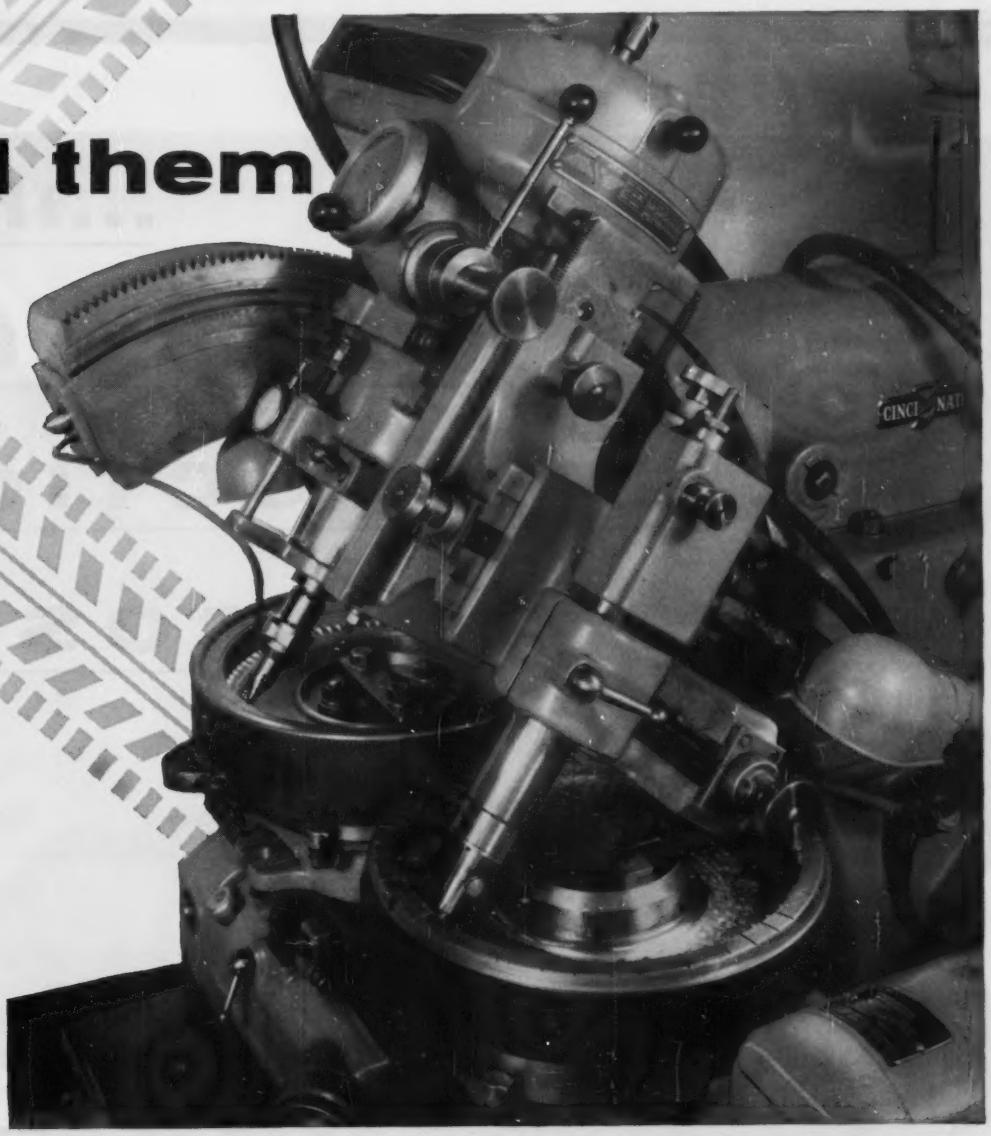
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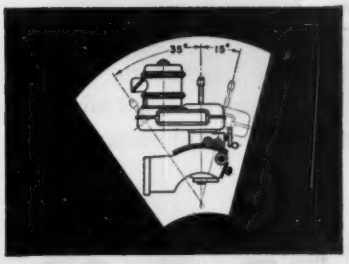
CINCINNATI 8" x 18" Tool and Die Milling Machine. Brief specs. in Sweet's Machine Tool Catalog. Complete information in catalog No. M-1731.

CINCINNATI

find them

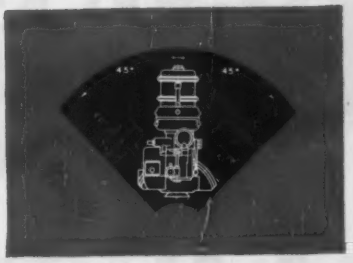


Milling the tread in a tire mold. The machine is a CINCINNATI 8" x 18" Tool and Die Miller, equipped with a power driven Duplex Rotary Table Attachment.



Transverse swivel range of spindle

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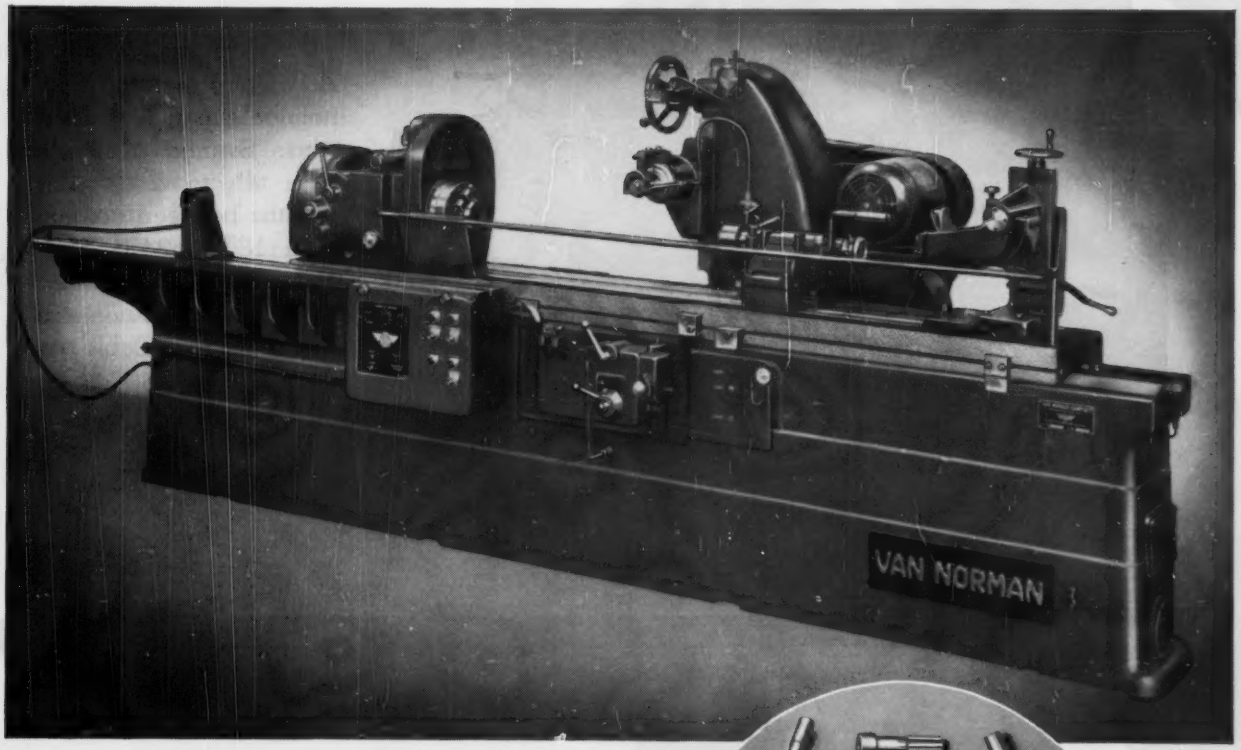
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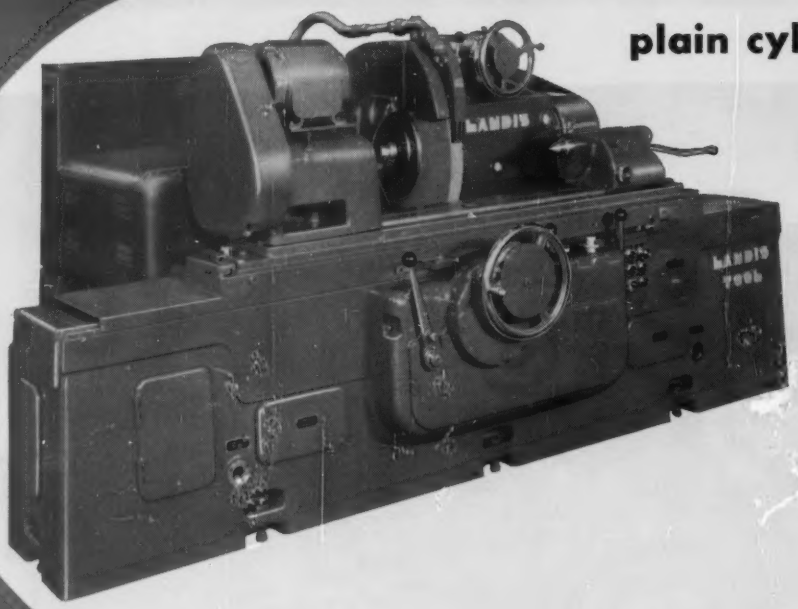
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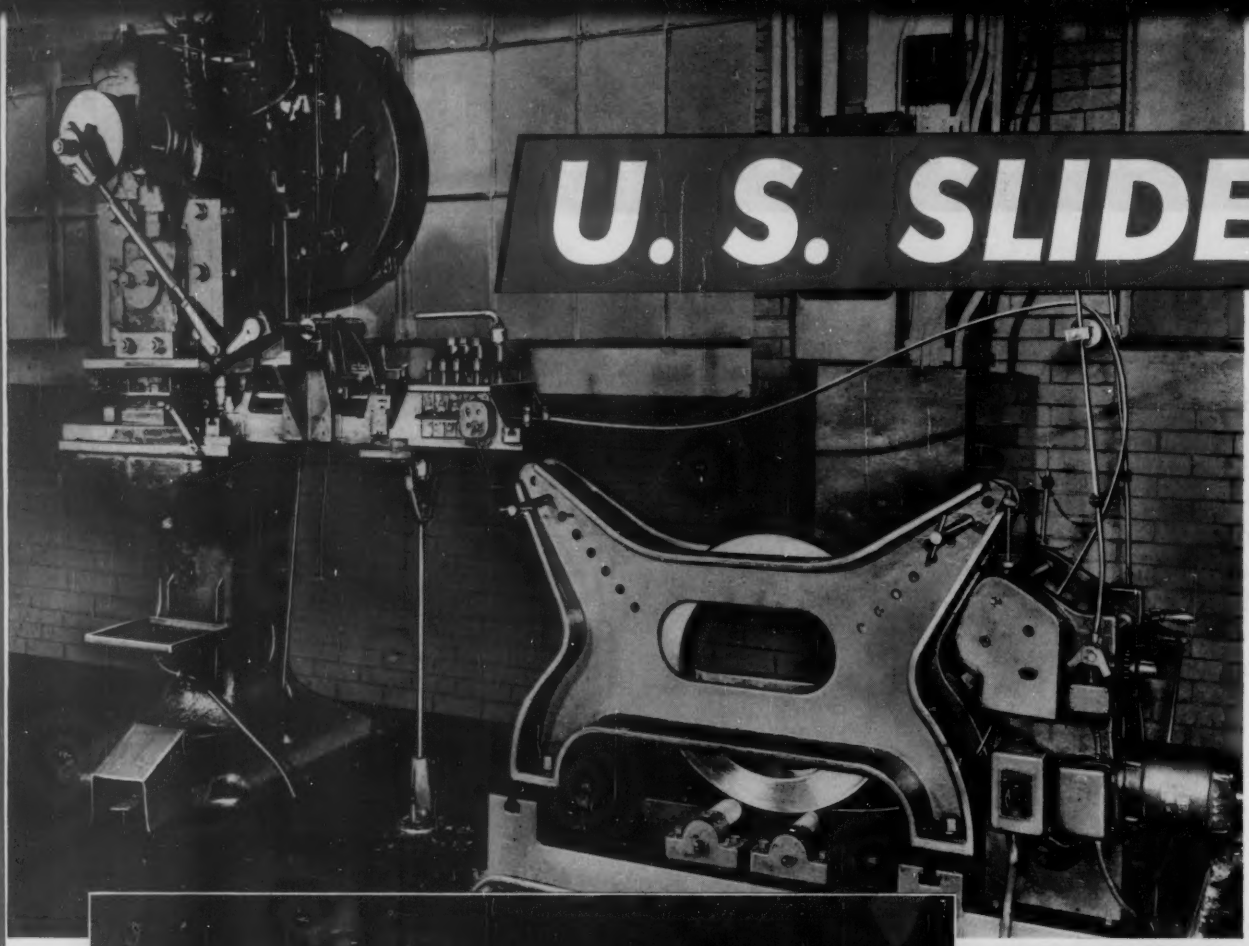
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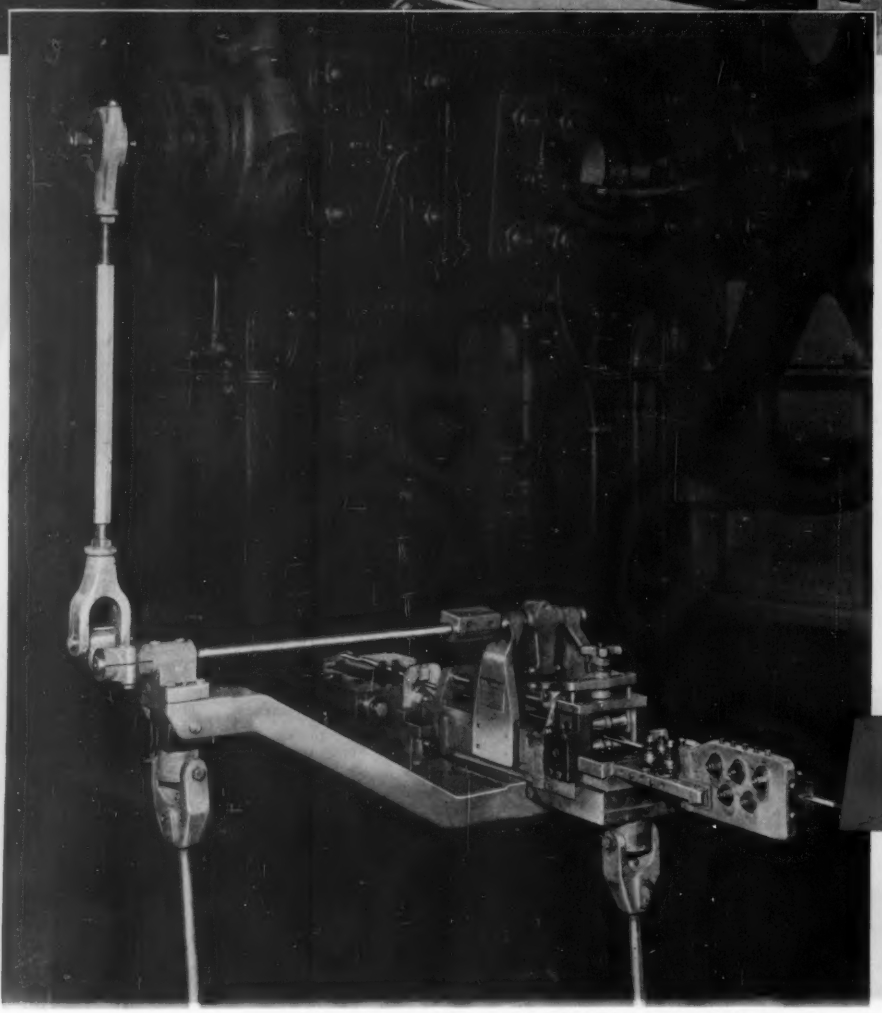
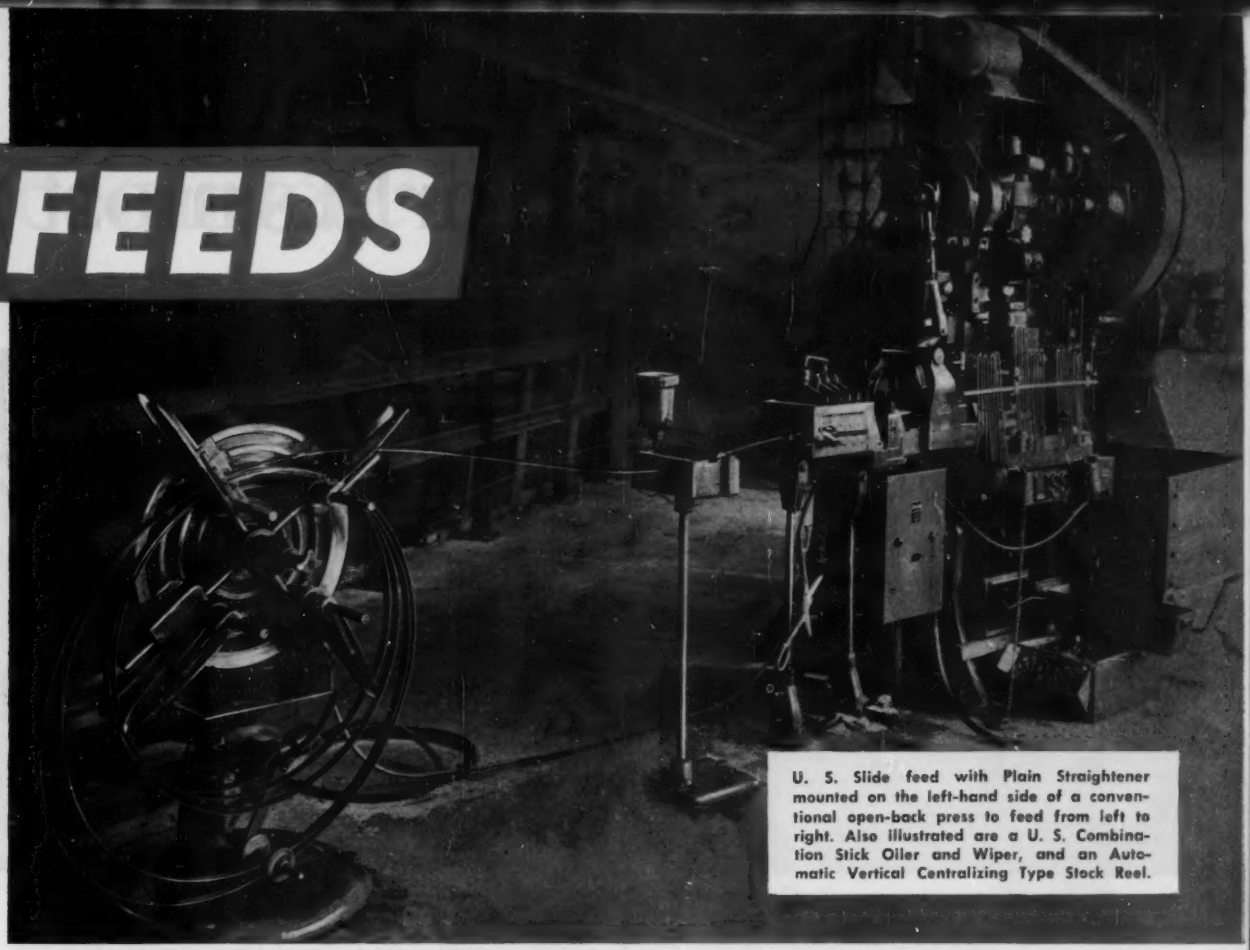


Photo above shows a U. S. Slide Feed with a U. S. Plain Straightener mounted for feeding right to left on a press with crankshaft running from front to back, instead of left to right as on conventional presses. Also shown in photo is a U. S. Automatic Coil Cradle.

Photo at left shows a U. S. Slide Feed arranged with a Two-Way Wire Straightener to feed round wire from front to back into a straight-sided press.

U. S.

FEEDS



U. S. Slide feed with Plain Straightener mounted on the left-hand side of a conventional open-back press to feed from left to right. Also illustrated are a U. S. Combination Stick Oiler and Wiper, and an Automatic Vertical Centralizing Type Stock Reel.

Do These Jobs Suggest Answers to Your Press Feed Problems?

The illustrations on this and the facing page show U. S. Slide Feeds being used with three different types of presses. In each case the user is obtaining benefits as follows:

ACCURACY . . .
U. S. Slide Feeds are generally recognized as the most accurate automatic feeds on the market for feeding material into punch presses. The slide block, which contains the blade to grip the material, reciprocates on hardened and ground slide rods between adjustable stops, insuring controlled accuracy of feed length.

VERSATILITY . . .
As illustrated, U. S. Slide Feeds can be arranged for use with different types of presses for feeding left to right, front to back, back to front, etc. They can also be used for feeding different types of material in coils: steel, brass, copper, aluminum, paper, cardboard, fibre, plastic, etc., and they can be arranged for butt feeding short strips when material is over .030″ in thickness and of suitable stiffness.

AUTOMATIC OPERATION . . .
The use of a U. S. Slide Feed converts the press into an automatic machine, resulting in reduced costs and increased production. All the operator has to do is thread and start new coils of material.

If press operations are included in your production, U. S. Slide Feeds may be the answer to your feeding problems. Ask for a copy of Bulletin 80-M, which contains complete specifications.



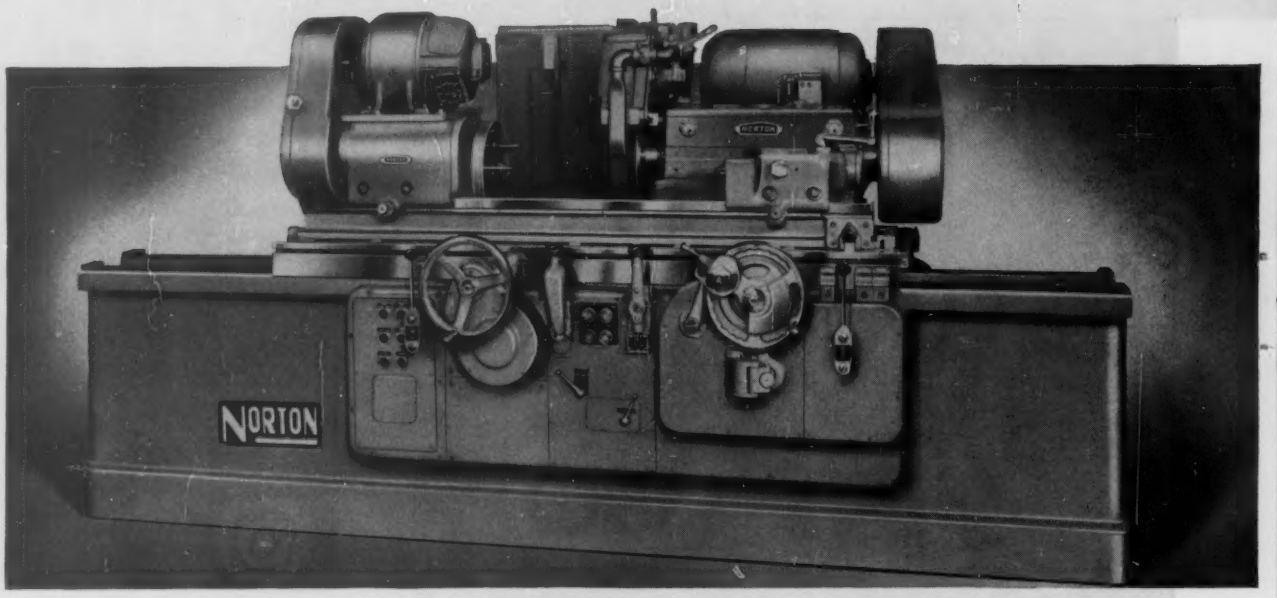
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Ampere (East Orange) New Jersey

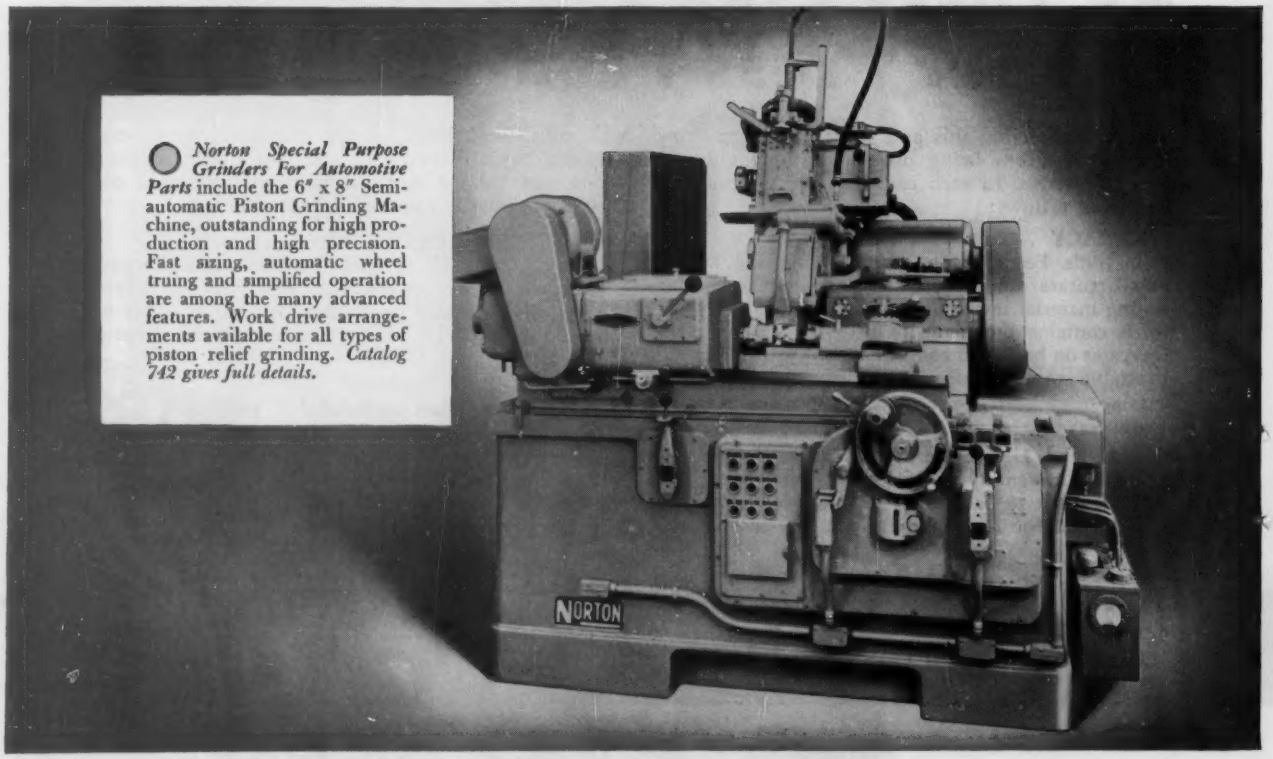
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Norton Tool Room Cutter Grinders. The No. 20 Cutter and Tool Grinder is the most versatile machine in its class. The wheel head tilts up to 15° above or below horizontal, and may be swivelled through 360° — simplifying such jobs as grinding taper reamers, step counterbores, form tools and milling cutters. Other pace-setting advantages include long table traverse and wheel slide travel . . . integral motor spindle . . . wheel slide graduated dials readable from any angle. No other cutter and tool grinder does so many jobs so fast, so easily. *Catalog 189 tells you why.*



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Only Norton offers you such long experience in both grinding machines and wheels to help you produce more at lower cost.

The six machines shown here are typical products of that experience — bringing you ahead-of-the-parade design that speeds production and adds maximum product-value on every job they do for you.

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A new illustrated folder #1843 lists the entire Norton line of grinding and lapping machines and tells you how to get all the facts on each unit. For your copy, write to NORTON COMPANY, Machine Division, Worcester 6, Mass. *In Canada:* J. H. Ryder Machinery Co., Ltd., Toronto 5.



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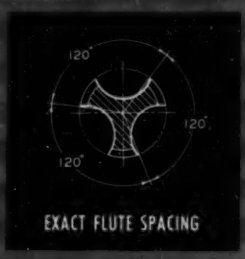
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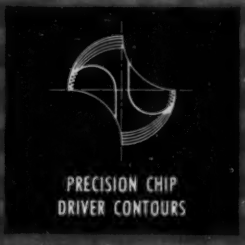




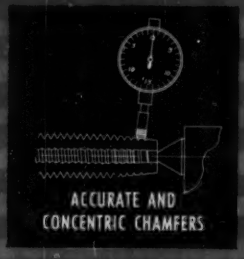
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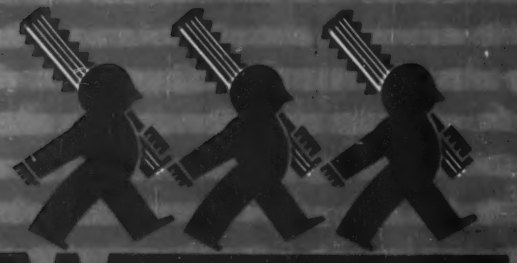
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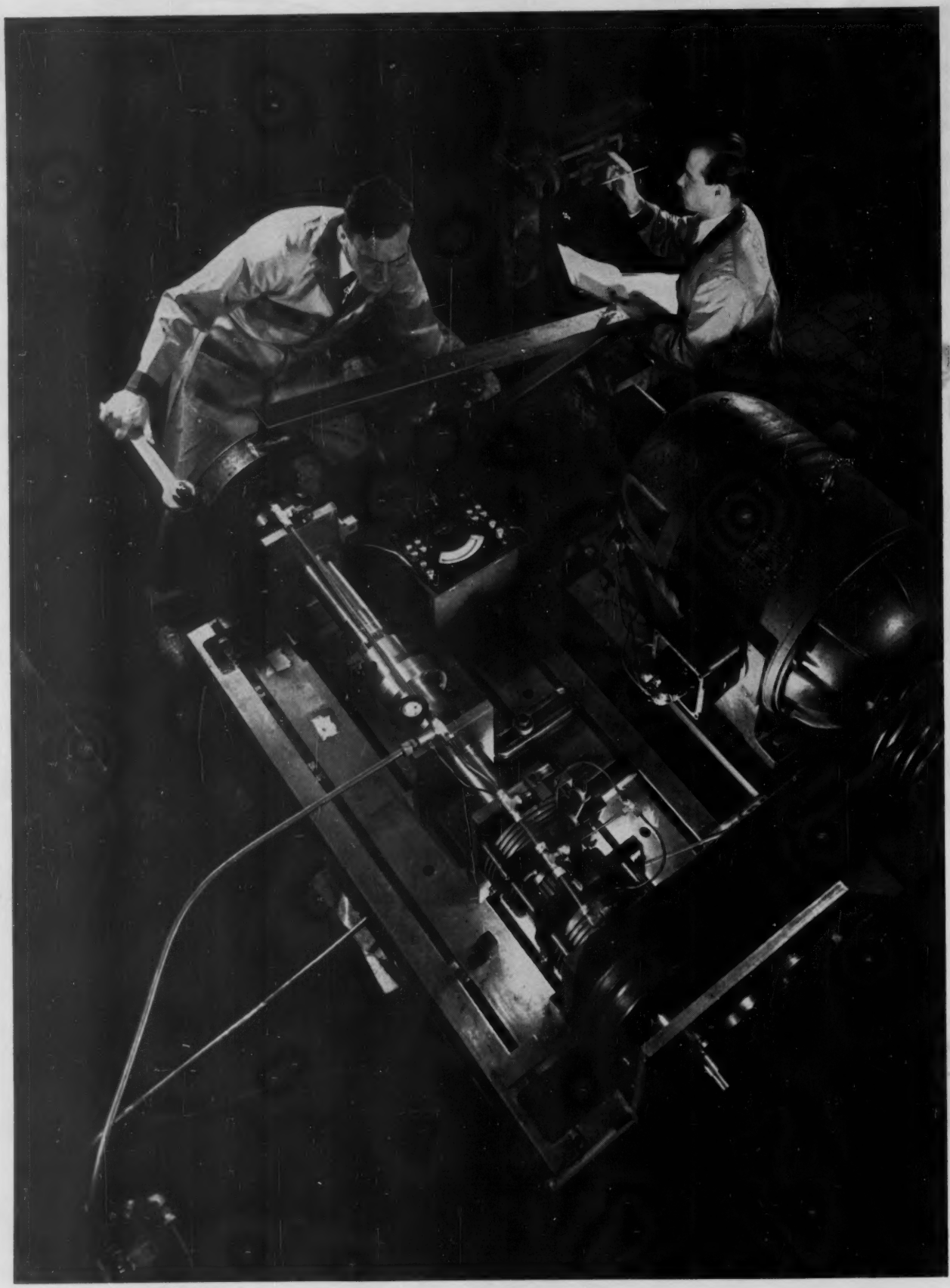
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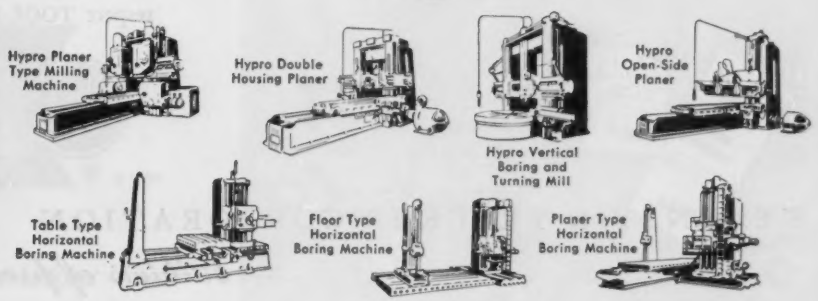
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Kearney & Trecker Corp.

■

JUST four short months ago — as this is written — Kearney & Trecker demonstrated again its leadership in the machine tool industry by pioneering a program, unique among machine tool manufacturers, whereby its products might be obtained on a lease basis, as well as by outright sale or conditional sales agreement.

The results of the Kearney & Trecker TOOL-LEASE program have exceeded even our most optimistic forecasts. It has been a great stimulant of inquiries and new business, particularly where the replacement of worn and obsolete milling and precision boring equipment has been under consideration.

At this time the TOOL-LEASE program has been responsible for several million dollars' worth of new business. The success of this program is ample evidence that our decision to lease was founded on a correct appraisal of the needs of metalworking industry for some way to modernize its plant equipment without delay where working capital for the moment must be used for other purposes. In this respect TOOL-LEASE is serving a practical and

KEARNEY & TRECKER CORPORATION

builders of precision and production

TOOL-LEASE

useful purpose, and we are both pleased and grateful for the acceptance this program has been accorded.

The Kearney & Trecker TOOL-LEASE program today is an integral part of our company's general sales policy. The soundness of the program is evidenced — not only by the 120 day record of leases made by large and small companies alike — but also by the many complimentary letters received from leading figures in almost every executive capacity in business and industry.

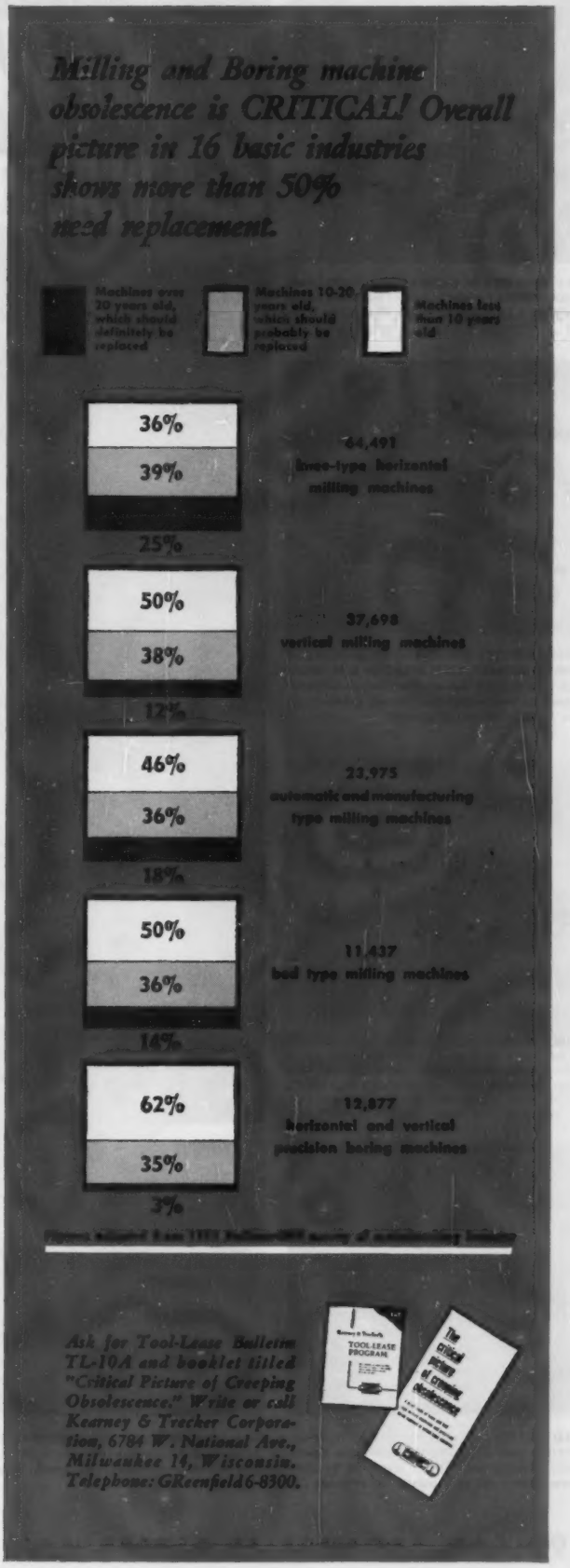
Today our sales organization is fully prepared to explain the details of the Tool-Lease program to anyone interested. Briefly, it offers a choice of three basic plans with varying options to continue the lease, terminate the lease or purchase the equipment.

Among the proved advantages of Tool-Lease are: Releases working capital for production expansion. Assures you the services of a machine as long as needed, avoiding risk of obsolescence. Permits user to judge machine's merits in actual shop performance without going to expense of purchasing the machine.

We invite your letters of inquiry. For complete details on Tool-Lease including actual costs . . . for prompt service and assistance in analyzing your plant modernization problems — contact the Kearney & Trecker sales representative in your area.

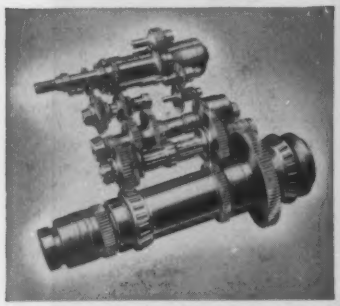
TOOL LEASE
KEARNEY & TRECKER
MILWAUKEE
MACHINE TOOLS
EQUIPMENT
® ©1954

machine tools - since 1898

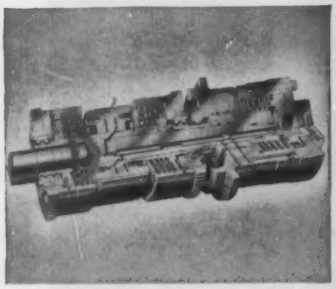




MORE POWER—as much as you'll need for any job! Motor range: 2-A, 15 to 40 hp.; 3-A, 25 to 60 hp.; 4-A, 30 to 75 hp.



16-SPEED DRIVE provides closer grouping of speeds in natural work range to turn more work diameters more effectively—increase production and tool life. 2-speed motor provides 32 *un-duplicated* speeds!



MAINTENANCE-FREE, instant-acting forward and reverse clutch and headbrake unit never needs adjustment—engage smoothly and virtually instantaneously providing fast starts, stops, and reverses.

NEW WARNER & SWASEY INCREASED EFFICIENCY, GREATER



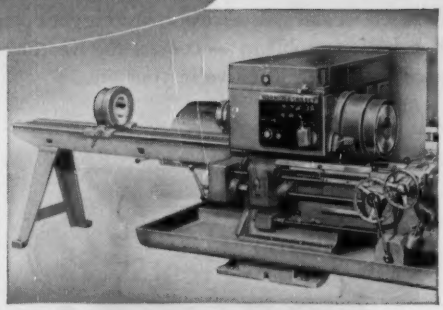
2-A	Chucking Swing	20"
	Bar Capacity	3-1/2" or 4-1/2"
	Motor	40 hp
3-A	Chucking Swing	23-1/2"
	Bar Capacity	4-1/2" or 6"
	Motor	60 hp
4-A	Chucking Swing	28-1/4"
	Bar Capacity	9" or 12"
	Motor	75 hp

New 1-A also available





SPEED PRE-SELECTION made easy by large direct reading indicator dial. AUTOMATIC GEAR SHIFTING boosts production, reduces operator fatigue. A single movement of the control handle without any further attention by the operator slows spindle to crawl speed, then shifts to new speed—all in a matter of seconds.

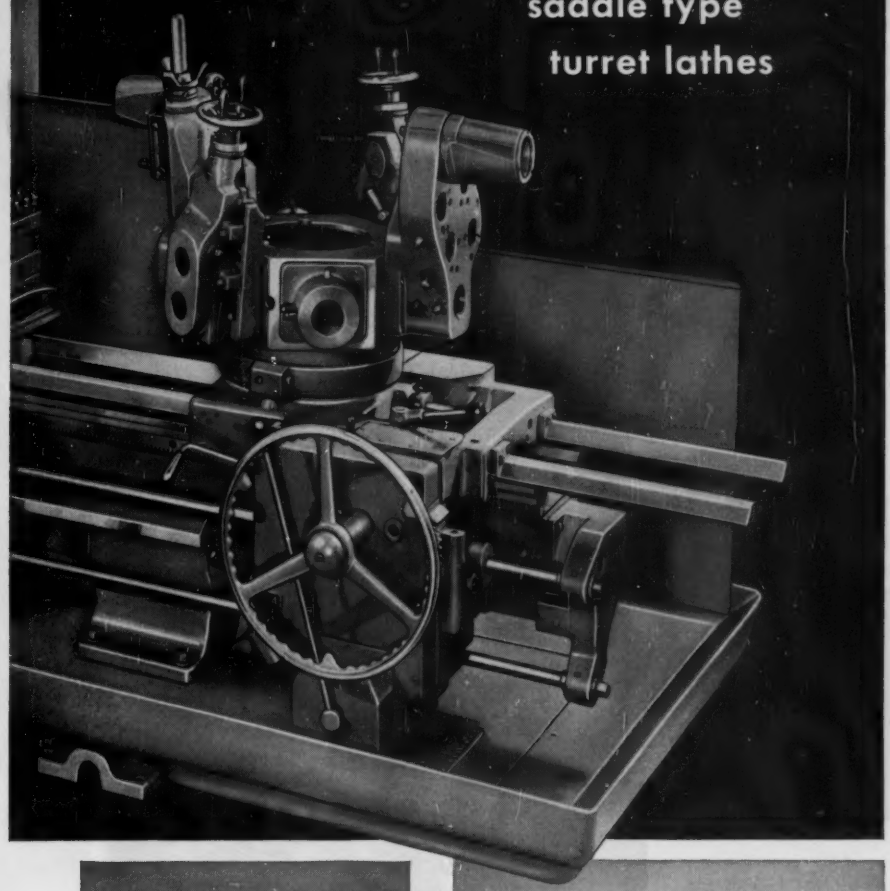


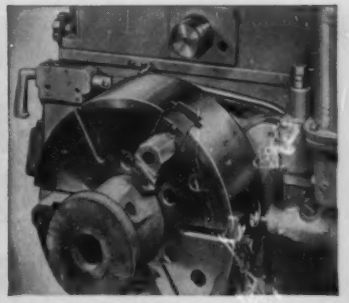
NEW HYDRAULIC CHUCK AND BAR FEED and power return. Provides easier handling, less operator fatigue—increased production.

YOU CAN PRODUCE IT BETTER, FASTER, FOR LESS WITH WARNER &

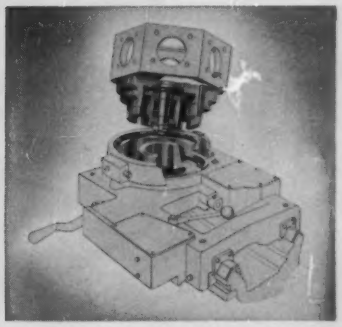
DESIGN FEATURES GIVE YOU PRODUCTION, MORE PROFITS!

A completely new line of saddle type turret lathes

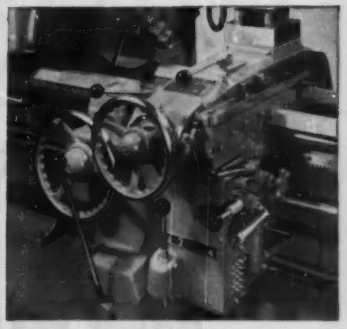




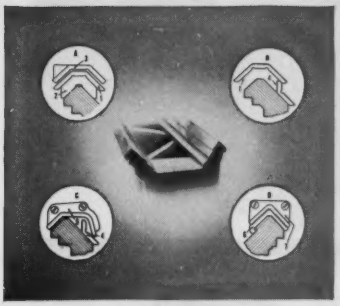
NEW POWER CHUCK WRENCH eliminates back-breaking effort when chucking. Grips and holds delicate work or heavy forgings. Does not obstruct spindle bore.



ACCURATE LOCATING AND LOCKING HEX TURRET assures maintained accuracy. Single lever controls both locating and clamping of turret.



FAST OPERATING CROSS SLIDE. All controls within easy reach. 4-way traversing with rapid traverse lever. Monoshift lever provides fast feed changes. Open type square turret for flexible tooling.



INDUCTION HARDENED VEE-BEDWAYS assure long accurate life. Exclusive way covers protect bearing surfaces from damage by dropped tools, chips, and loss of way lubrication.



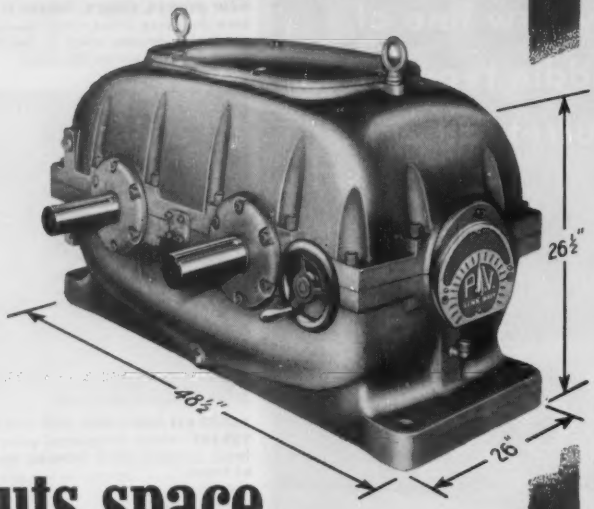
INCREASED STRENGTH WITHOUT INCREASED WEIGHT. Scientific diagonal rib design gives over 30% added strength —greater rigidity and long-term accuracy.

WARNER & SWASEY
Cleveland
PRECISION MACHINERY SINCE 1880

SWASEY MACHINE TOOLS, TEXTILE MACHINERY, CONSTRUCTION MACHINERY

For more information on products advertised, use Inquiry Card, page 243

LINK-BELT 25-hp P.I.V. Variable Speed Drive



cuts space requirements up to 50%

LINK-BELT gives you all the advantages of positive, stepless speed changing in high horsepowers, too

ONE of the great advantages of P.I.V.'s positive, all-metal drive is dramatically illustrated by the Size 6. Compared to other speed changers in this hp range, it saves *70 cu. ft. of space!*

In addition, infinitely stepless regulation means you can select the exact speed you want—from maximum to minimum. Unaffected by temperature and atmospheric conditions, all moving parts are totally enclosed and splash-lubricated.

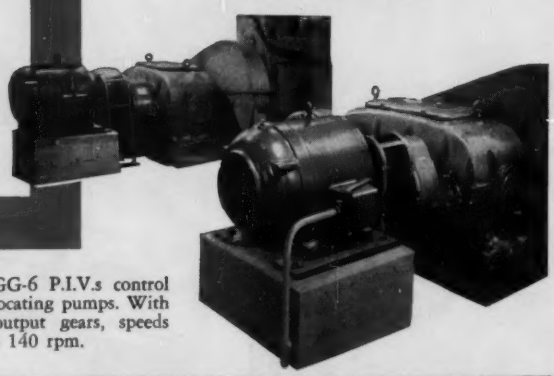
The Size 6 P.I.V. is built in three types: The basic drive . . . with input *or* output gears . . . with input *and* output gears. All are available in a wide range of ratios, 20 to 25 hp.

Get the facts on the Size 6 from your nearest Link-Belt office or distributor. You'll receive a copy of Folder 2374. And for information on the complete P.I.V. line, ask for Book 2274.

LINK-BELT P.I.V. VARIABLE SPEED DRIVE

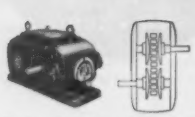
13.594

LINK-BELT COMPANY: Executive Offices, 307 N. Michigan Ave., Chicago 1. To Serve Industry There Are Link-Belt Plants, Sales Offices, Stock Carrying Factory Branch Stores and Distributors in All Principal Cities. Export Office, New York 7; Canada, Scarboro (Toronto 13); Australia, Marrickville, N.S.W.; South Africa, Springs. Representatives Throughout the World.

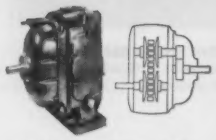


Two Link-Belt HGG-6 P.I.V.s control the speed of reciprocating pumps. With both input and output gears, speeds range from 46.5 to 140 rpm.

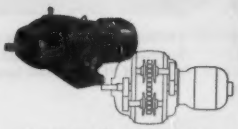
4 OF 16 P.I.V. TYPES
HORIZONTAL OR VERTICAL MOUNTINGS
⅓ TO 25 HP—
RATIOS TO 6:1



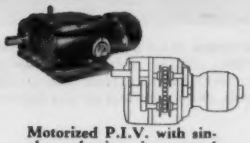
Basic, Positive, Infinitely Variable (P.I.V.) Speed Drive.



P.I.V. with single reduction input or output helical gears.



Motorized P.I.V. with single reduction input and output helical gears.

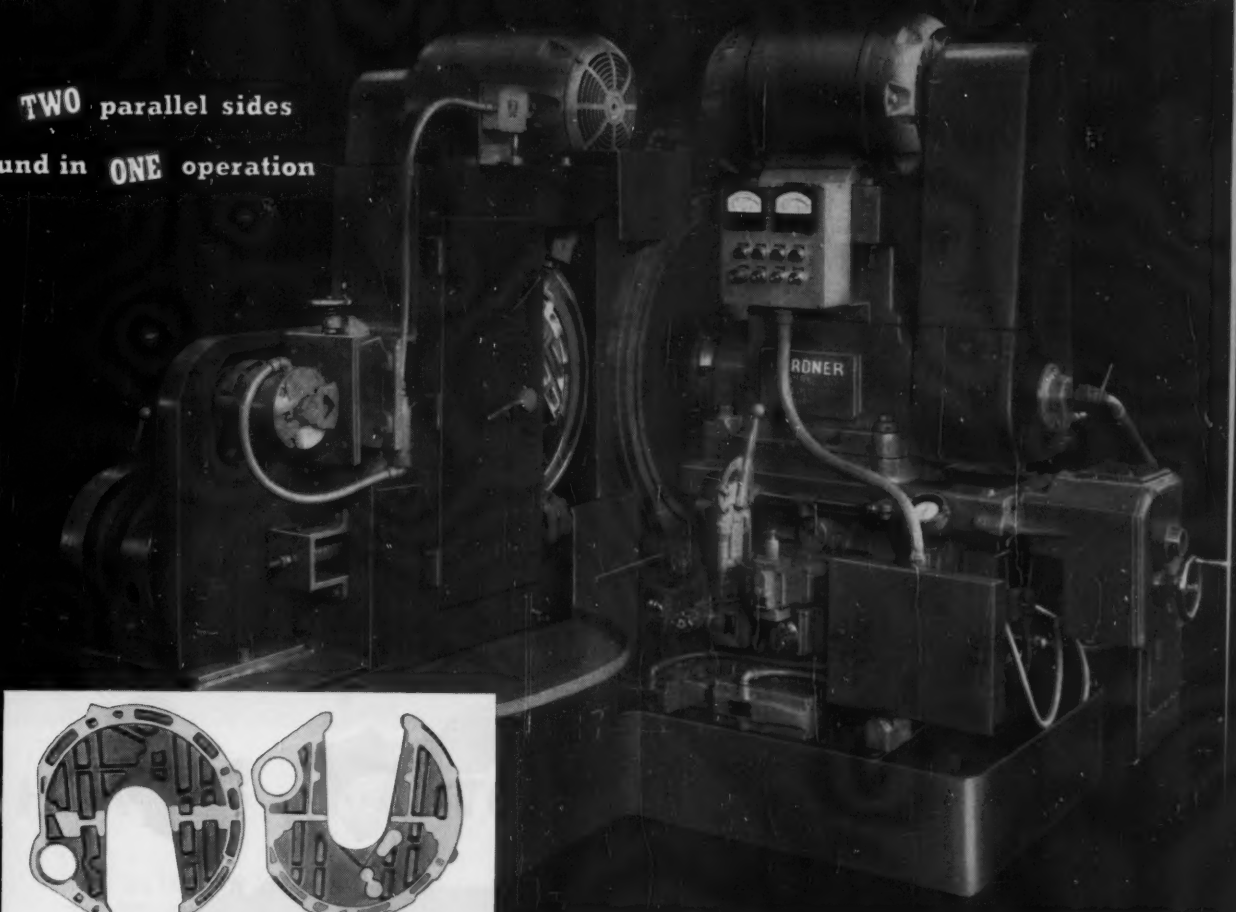


Motorized P.I.V. with single reduction input and double reduction output helical gears.

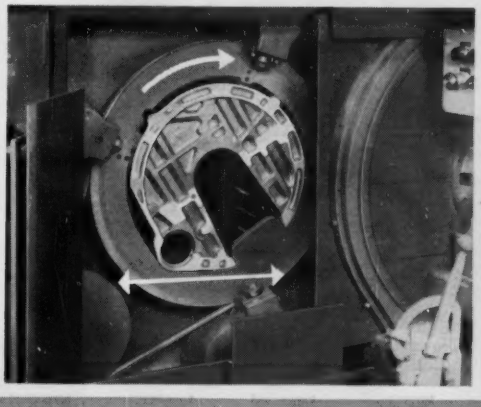
For more information on products advertised, use Inquiry Card, page 243

Unusual Grinding Problem Solved by "Floating" Principle of Gardner Grinding

TWO parallel sides
ground in **ONE** operation



1. Interrupted Cut 2. Irregular Shape 3. Unequal Areas



work data	
MACHINE	Gardner No. 125-30" Double Spindle Grinder.
PART	Torque converter adapter plate of aluminum alloy.
PRODUCTION	90 plates per hour.
STOCK REMOVAL	.100" overall.
TOLERANCES	.001" for parallelism and uniformity.
TOOLING	Hydraulically-oscillating work table with power driven, rotating work fixture. Work piece radially driven and free to float sidewise between the discs.
ABRASIVES	2 Gardner Yellow Rim Wire Lokt Abrasive Discs.

GARDNER MACHINE COMPANY
414 Gardner St., Beloit, Wisconsin, U. S. A.

132M

GARDNER
precision disc grinders

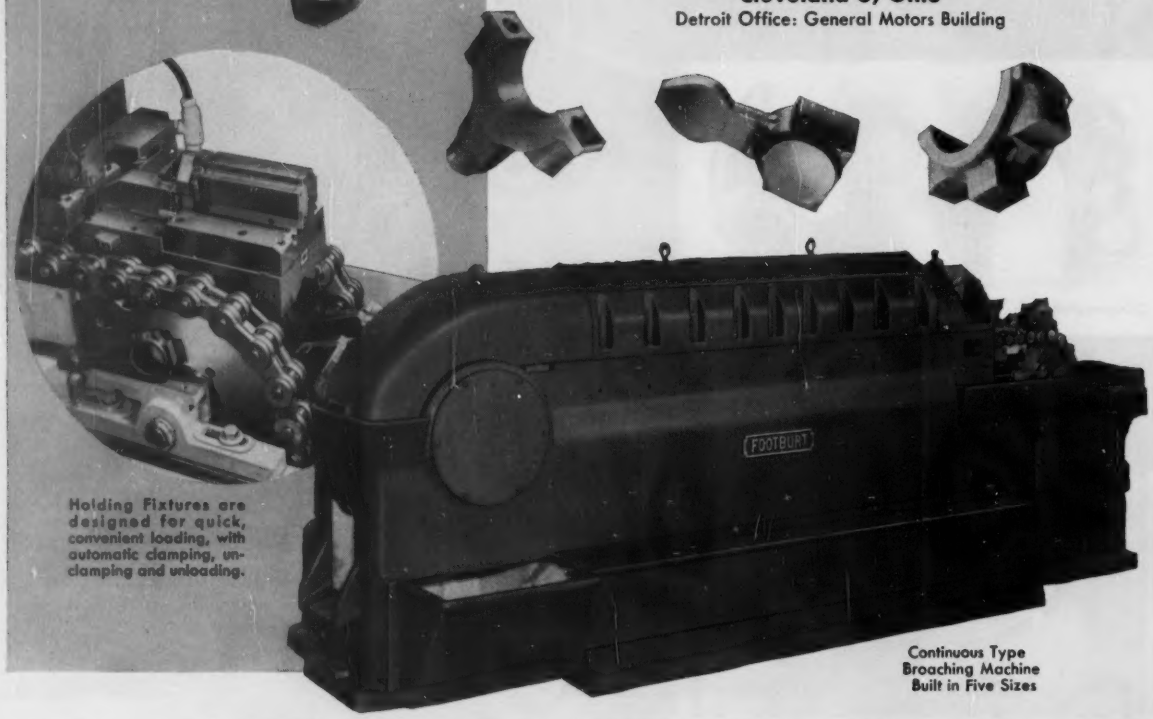


machining connecting rods and caps an opportunity for

SURFACE BROACHING

Surface Broaching is a modern machining method that in many cases shows reduced costs through higher production, finish to closer tolerance, and low tool maintenance costs. If you machine large quantities of duplicate parts we will be glad to work with you on the possibility of adopting Footburt Surface Broaching Machines. Send us blueprints and hourly production requirements for our recommendations.

THE FOOTE-BURT COMPANY
Cleveland 8, Ohio
Detroit Office: General Motors Building



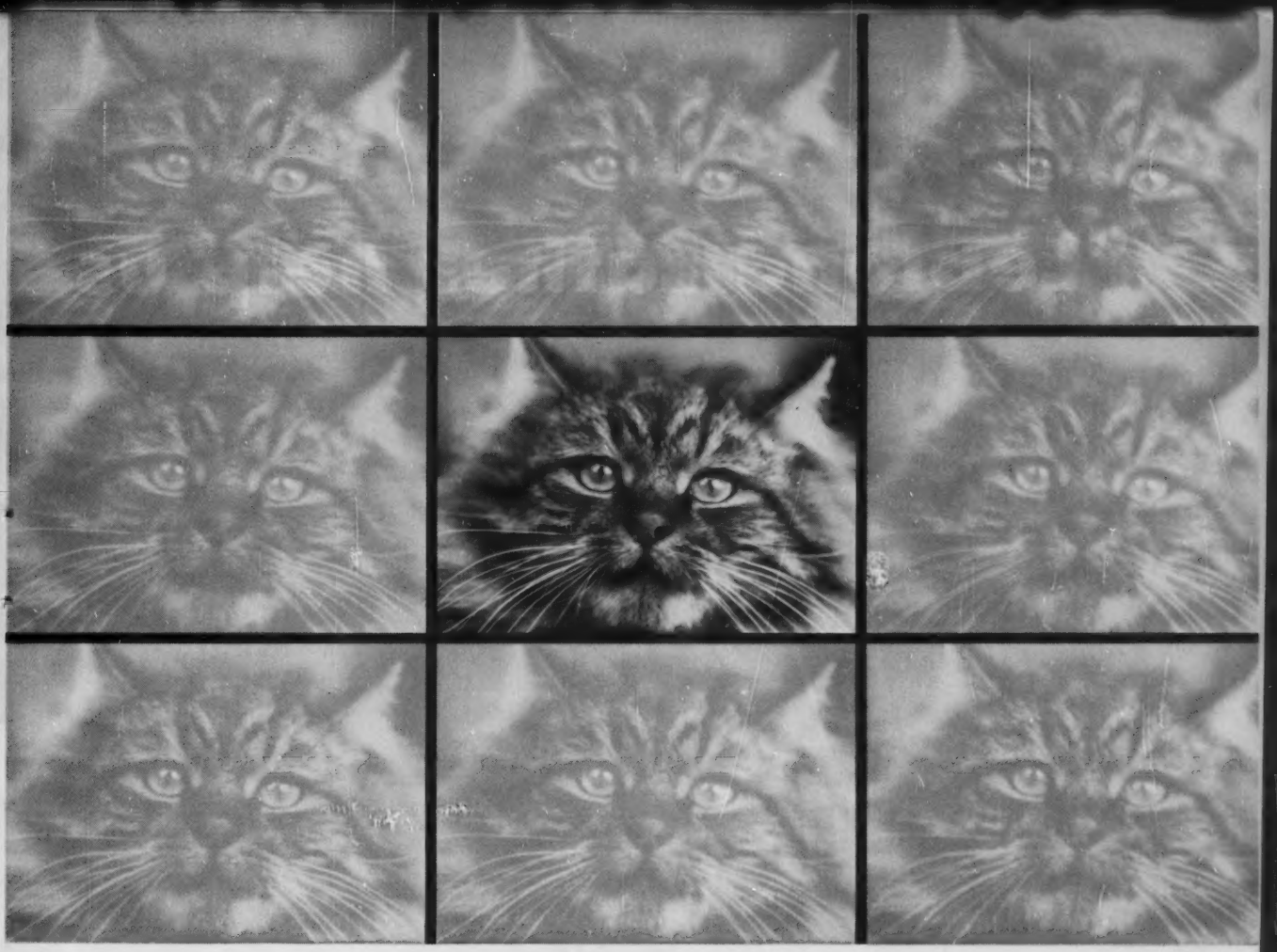
Holding Fixtures are designed for quick, convenient loading, with automatic clamping, unclamping and unloading.

Continuous Type Broaching Machine Built in Five Sizes

FOOTBURT

SURFACE BROACHING

For more information on products advertised, use Inquiry Card, page 243



How to give TOOLS extra lives . . .

. . . SWITCH TO CIMCOOL,° the radically new and different cutting fluid that increases tool life because it combines friction reduction and cooling capacity in a degree never before attained.

Excessive heat is destructive to cutting tools, shortens their life. But CIMCOOL increases tool life—and permits faster speeds—because this revolutionary coolant cools faster, through a unique physical change in the cutting fluid itself. Tools and chips actually stay cool to the touch.

CIMCOOL is far superior to old-fashioned petroleum-based cutting fluids because it is a *chemical emulsion*. It replaces all water emulsions and all but a few highly compounded specialty oils.

For a demonstration of how CIMCOOL increases tool life—just write us. We'll have one of our Cincinnati Milling-trained machinists call on you —without cost or obligation. Or, if you prefer, write for our free booklet, "Cimcool Defeats Heat." Address Sales Manager, Dept. M-94 Cincinnati Milling Products Division, The Cincinnati Milling Machine Co., Cincinnati 9, Ohio.

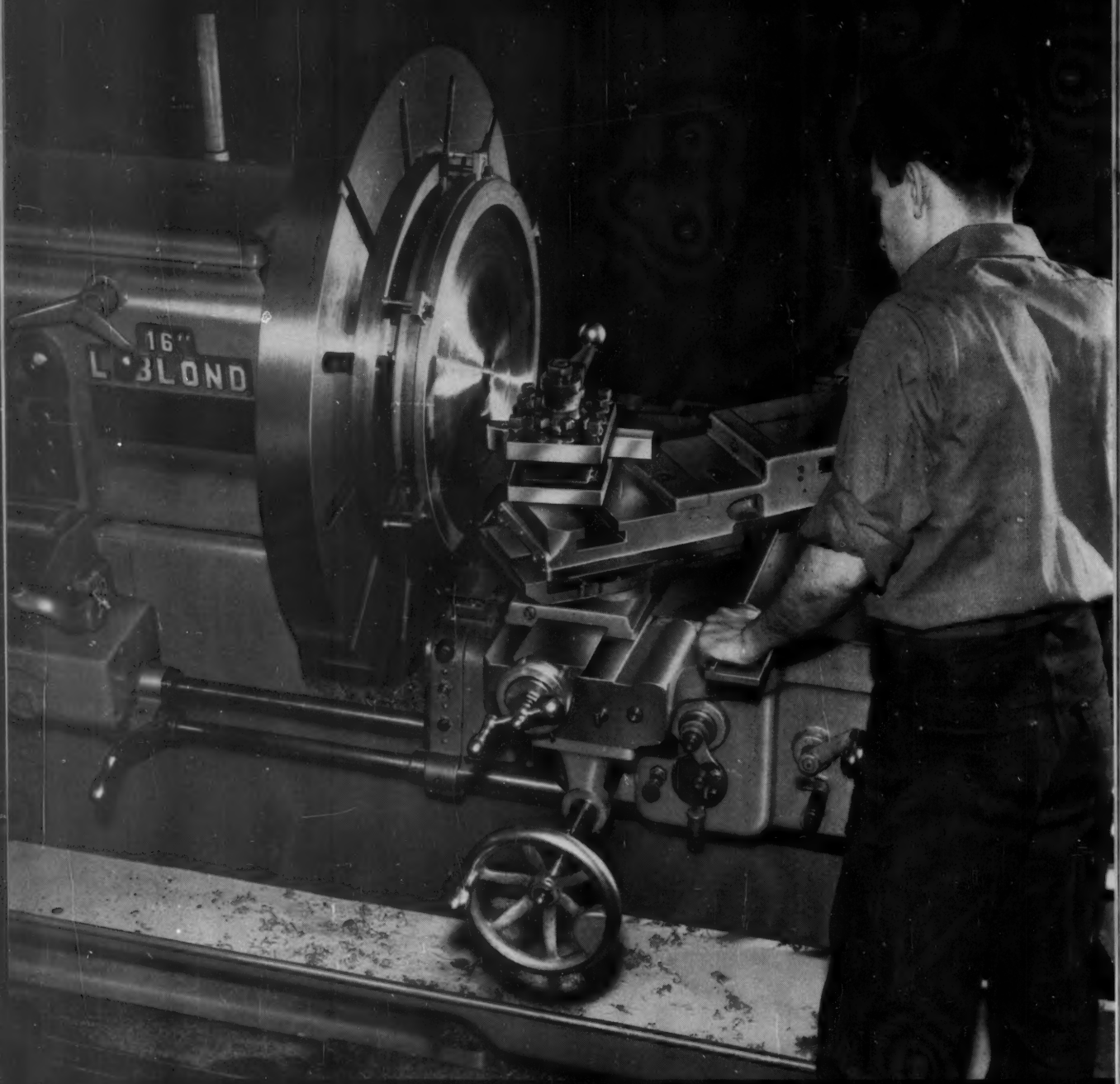
°Trade Mark Reg. U.S. Pat. Off.



CIMCOOL

A PRODUCTION-PROVED PRODUCT OF THE CINCINNATI MILLING MACHINE CO.

"LeBlond Lathes help us



Turning Tough Titanium— A LeBlond 16"/38" Sliding Bed Gap Lathe with Hydra-Trace* performing the difficult job of contour facing a titanium forging. Columbia Machine Products likes the LeBlond for its smooth power, rigidity and versatility.

turn tough Titanium successfully"

. . . says Columbia Machine Products, Brooklyn, N. Y.

Turning titanium is tough. Columbia builds its success on licking problems like this, and dependable equipment plays a vital role. To Columbia that means LeBlond Lathes—for the smooth power, rigidity and versatility they need.

For example, take the job shown on the left. A jet engine rotor compressor disc is being machined from a titanium forging. This contour job is faced on a LeBlond 16″/38″ Sliding Bed Gap Lathe equipped with LeBlond Hydra-Trace*. Operating specifications must remain Columbia's trade secret. We can say, however, that they must hold tolerances as close as .0005″ and finish to 32 microinches.

Columbia explains, "Since these titanium forgings are extremely costly, yet have no chip or scrap value, we must have dependable accuracy and finish without spoilage. Speed is important, too, because of the substantial amount of material that must be removed. LeBlond Lathes have what it takes to do jobs like this successfully, at competitive prices. One word sums up our feelings about LeBlonds—Excellent!"

Whether you're turning tough titanium or more conventional materials, one of LeBlond's 76 lathe models will fill the bill—exactly! LeBlond offers a complete line of lathes from the 13″ Regal to the 50″ Heavy Duty. Also available are Sliding and Plain Bed Gap lathes; Hollow Spindle lathes; Dual Drive lathes; Tool Room and Rapid Production lathes. For the *right* lathe for your job, call your nearby LeBlond Distributor, or write us.

Ask for Catalog 54-D for a description of LeBlond's complete line.

*Hydra-Trace (Trade Mark, Registered U. S. Pat. Office) is LeBlond's heavy-duty hydraulic tracing attachment. Can be mounted in place of the compound rest on practically all LeBlond Lathes.

turned faster by

LeBLOND of Cincinnati

THE R. K. LEBLOND MACHINE TOOL COMPANY, CINCINNATI 8, OHIO

WORLD'S LARGEST BUILDER OF A COMPLETE LINE OF LATHES • *FOR MORE THAN 66 YEARS*

For more information on products advertised, use Inquiry Card, page 243

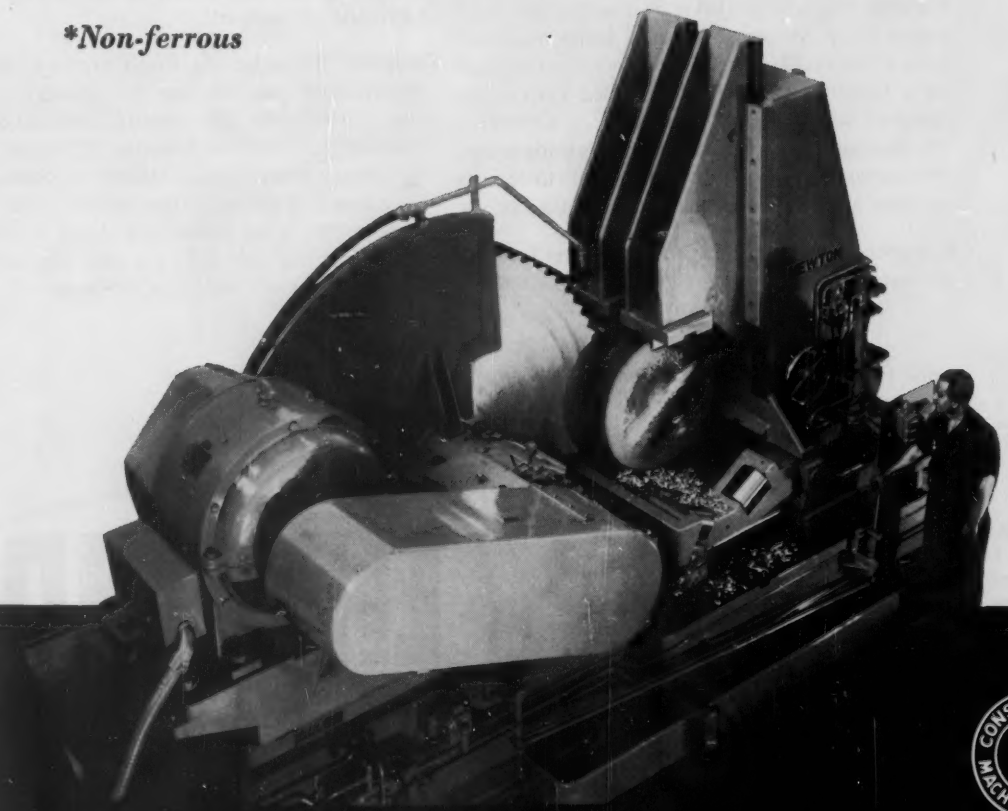
Saws Big N.F.* Billets

This 108 Inch Newton Cold Saw saws these 34 inch diameter non-ferrous billets in 80 seconds!

Its 100 H.P. motor whirls 9 foot diameter saw discs up to mile-a-minute cutting speeds in non-ferrous metals!

This is a big saw. It weighs 50 tons! But Consolidated also builds larger saws and smaller ones.

***Non-ferrous**

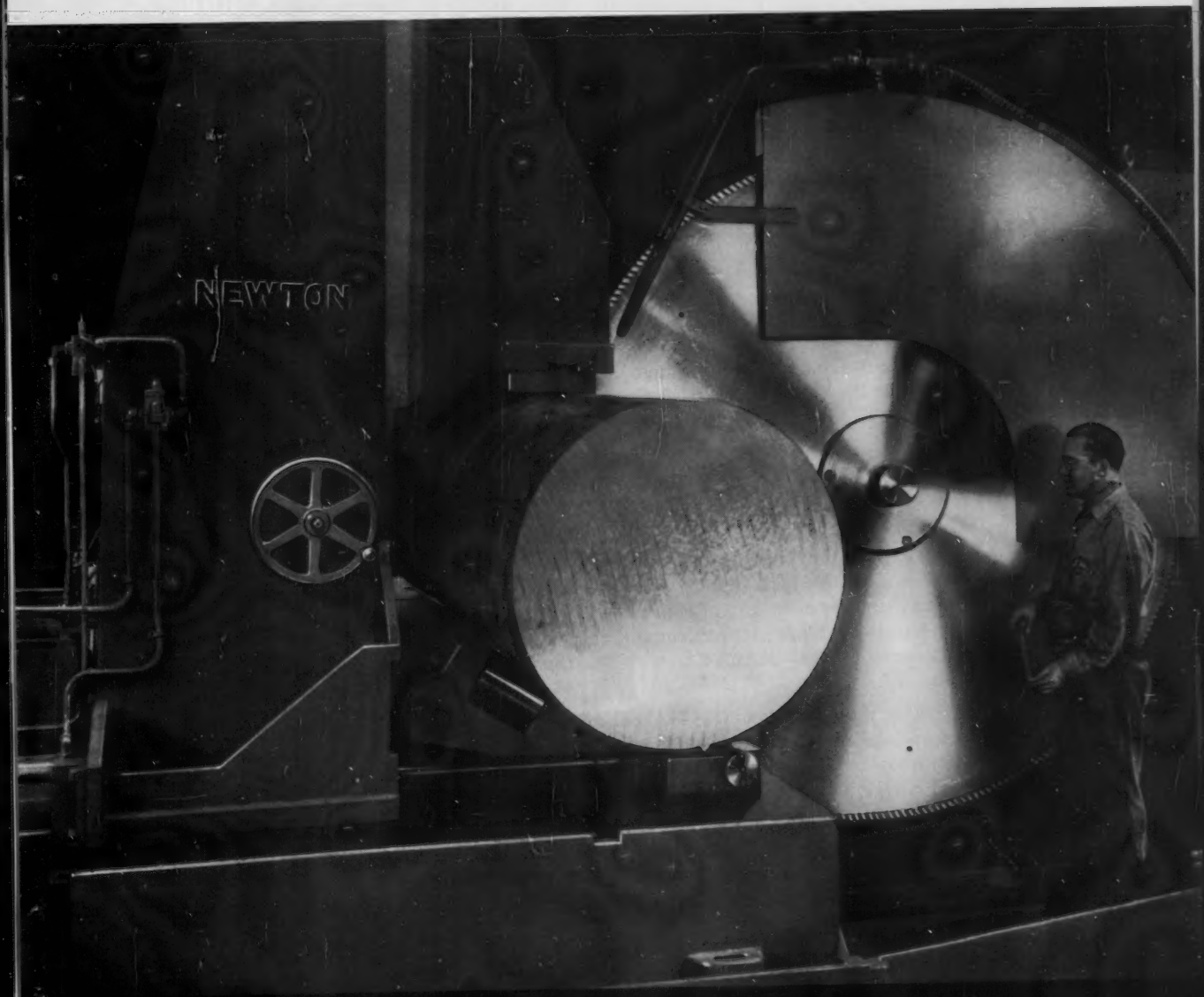


CONSOLIDATED MACHINE TOOLS

CONSOLIDATED MACHINE TOOL

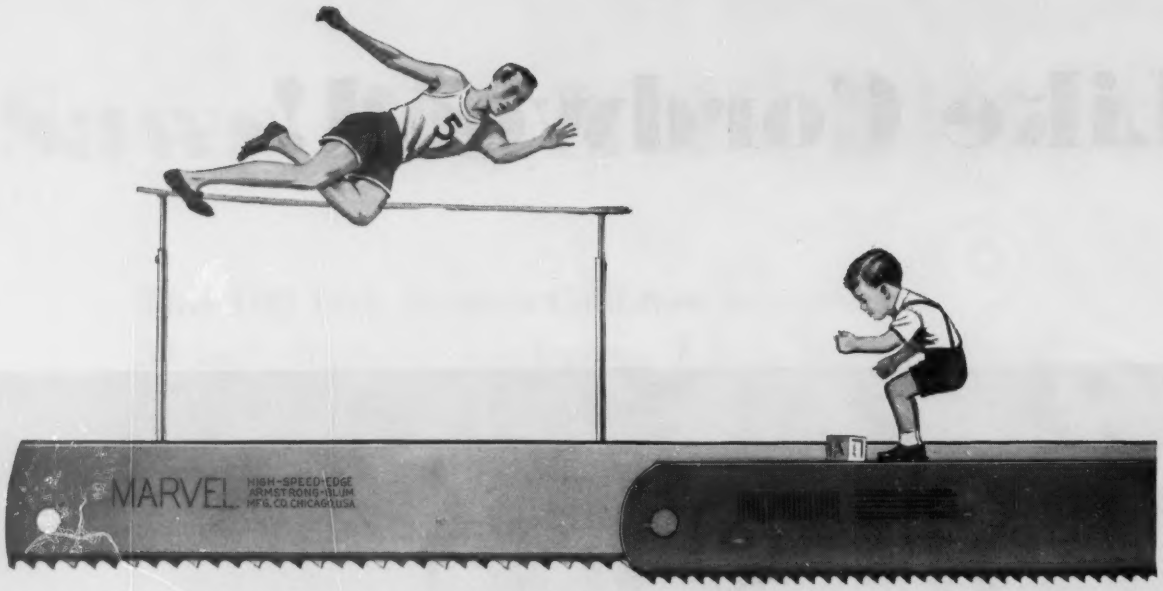
Wholly owned subsidiary of Farrel-

Like Cordwood!



CORPORATION, ROCHESTER, N. Y.

Birmingham Company, Incorporated



. . . *but*
Experience Cannot be Copied

More than a quarter-century ago MARVEL invented and basically patented the MARVEL High-Speed-Edge Hack Saw Blade—the UNBREAKABLE blade that increased hack sawing efficiency many-fold.

Every MARVEL Hack Saw Blade ever sold has been of that basic welded high-speed-edge construction, with constant improvements from year to year, as EXPERIENCE augmented the "know-how" . . .

MARVEL is not "tied" to any single source of steel supply, and has always used the best high speed steels that became available from time to time as metallurgy progressed. When-as-and-if finer steels are developed—and are proven commercially practical for welded-edge hack saw blades—MARVEL will use them, regardless of cost or source . . .

There is only one genuine MARVEL High-Speed-Edge! All other "composite" or "welded-edge" hack saw blades are merely flattering attempts to imitate — without the "know-how" of MARVEL EXPERIENCE . . .

Insist upon *genuine* MARVEL High-Speed-Edge when buying hack saw blades—and be SAFE, for you can depend upon MARVEL. They have been "tested", "pre-tested", and "re-tested" by thousands of users for more than a quarter-century!

MARVEL *Metal Cutting* SAWS
Better Machines-Better Blades

ARMSTRONG-BLUM MFG. CO. • 5700 Bloomingdale Ave. • Chicago 39, U. S. A.

For more information on products advertised, use Inquiry Card, page 243

Production Pointers from GISHOLT

TIME-SAVING IDEAS



Presented as a service to production men, we hope some of these interesting ideas, chosen from thousands of jobs, will suggest ways to help you cut time and costs in your own work.

SAVING TIME ON 6 TYPES—AND 24 SIZES

No. 24 Hydraulic Automatic Lathe with Hydraulic Tracer Unit Speeds Output of Bearing Races

Put new zip and lower costs into bearing race production with *six* different types and *24* varying sizes? And do the whole job on only *one* machine? Sounds like quite an order, doesn't it?

It's really a pushover with the No. 24 Hydraulic Automatic Lathe—equipped with the Gisholt Hydraulic Tracer Unit. This user shows how inner and outer bearing races requiring spherical, straight or tapered bores can be handled with speed and ease.

In the first operation, longitudinal movement of the front carriage and transverse movement of the standard slide permit tools to turn the O.D. up to the chuck jaws and face the forgings. The longitudinal movement of the rear carriage carries the tooling toward the spindle, and the template-controlled Hydraulic Tracer Unit actuates the rear slide, causing tools to rough-generate the spherical bore (for this typical 18" O.D. part) and break the corners at the end of the cut.

Tracer Unit Holds Fine Tolerances

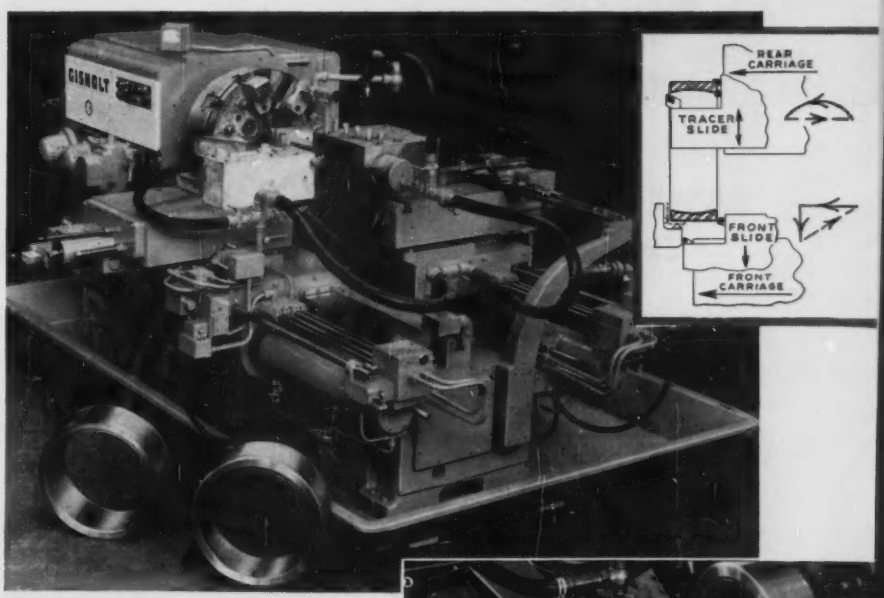
For the second operation the template is quickly re-located and the stops changed. Tools on the front slide finish turn the O.D. and face the other side. Tools on the tracer-controlled rear slide finish-generate the spherical bore, holding a .0005" tolerance, and then break the corners.

Each operation takes just 8 minutes f.t.f. with 90 lb. of tough bearing steel removed in less than 16 minutes total machining time. That's really knocking 'em out!

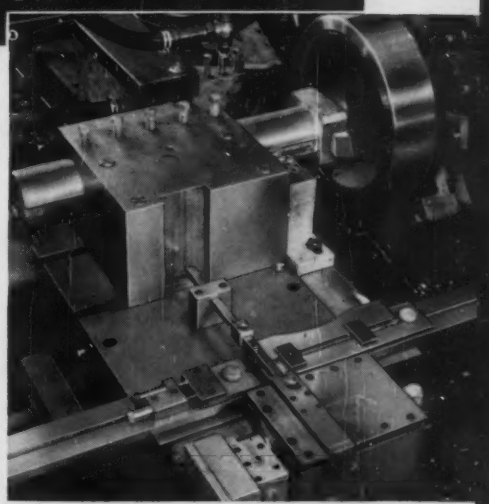
The Gisholt Hydraulic Tracer Unit operates at high pressure with slide movements controlled by a template and stylus-type follower. Square faces can be machined and cuts of ¾" depth at .035" feed are easily made. Setup is quick with convenient micrometer adjustment screws for accurate slide and template positioning.

The Hydraulic Tracer Unit is adaptable to other machines, too, for solving a wide variety of production problems. Your Gisholt representative can tell you about it and the No. 24 Hydraulic Automatic Lathe.

Quick changes for doing spherical, straight and tapered boring in a multitude of parts have one simple solution . . . the Gisholt Hydraulic Tracer Unit.



No. 24 Hydraulic Automatic Lathe set up for bearing race production.



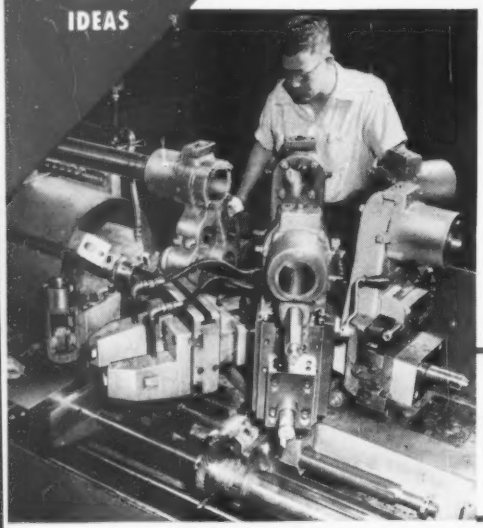
The hydraulic tracer controlled rear slide arrangement. Note the micrometer settings for positioning the template.

GISHOLT

TIME-SAVING IDEAS

HERE'S SOME TICKLISH INTERNAL BORING AND FORMING—*Done With Standard Slide Tools*

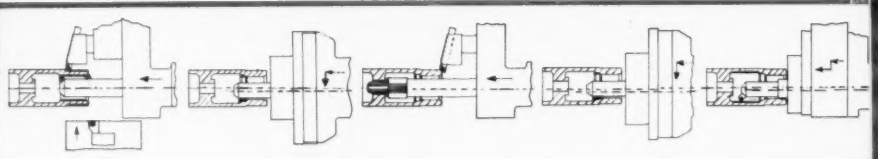
How the Gisholt Fastermatic Automatic Turret Lathe Reduces Time and Costs



The producers of these parts had the problem of going through an outer small diameter bore in order to get to a larger diameter bore inside. Ticklish as it sounds, they came up with "stock" tool answers to keep costs down.

The job's being done on a Gisholt 2F Fastermatic Automatic Turret Lathe with slide tools mounted on hexagon turret stations and operated by the standard back-facing attachment on the rear cross slide. After the tools have reached required depth through the small bore, the back-facing attachment actuates the slide which carries the tool the short distance necessary to complete internal machining operations. The workpieces—which are malleable iron valve castings—are machined in a floor-to-floor time of 4.2 minutes.

Here standard tools working in close quarters cut costs with internal boring and forming of castings completed in one fast, automatic cycle.



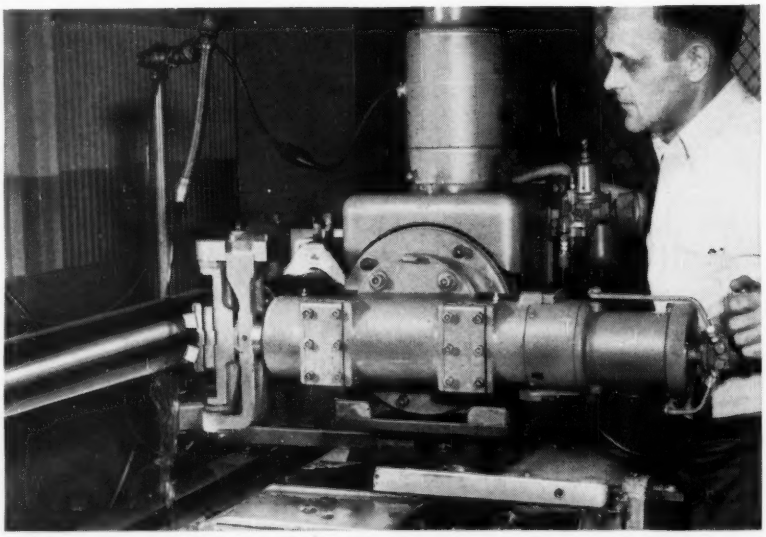
SAVES UP TO 3½ HOURS PER PART...INSURES BETTER CHROME PLATING BY SWITCH TO SUPERFINISH

Inexpensive Attachment for Turret Lathe

Long life and fine operation make it necessary that these forged steel piston rods for hydraulic presses be chrome plated. Production was slow and costly—penalized by a polishing operation which required four hours to complete.

A dramatic answer to this time problem was provided by Superfinishing. Now, the piston rods are turned on this Gisholt 3L Saddle Type Turret Lathe and Superfinished via an inexpensive attachment—right on the lathe. There is no polishing operation this way; only 30 minutes are needed to Superfinish. The saving in time: 3½ hours!

Not only is the geometry of the piston rod improved by Superfinishing, but the surface is also brought down to true base metal which permits excellent, hard chrome plating. In this case, the turned surface of approximately 150 micro-inches R.M.S. is refined to a 5 to 7 micro-inch surface finish.



Surface finish on the piston rod is improved by Superfinishing over the former polishing method.

This simple attachment on a Gisholt Turret Lathe reduced a four-hour polishing operation to a thirty-minute Superfinishing job. Costs are lower, results much better.

The new SUPERFINISHING CATALOG tells about this important process, shows many interesting jobs. Write for yours.

GISHOLT

TIME-SAVING IDEAS

NOTHING LIKE THE CROSS-FEEDING HEXAGON TURRET FOR JOBS LIKE THIS

Heavy Parts Simultaneously Machined at Both Ends

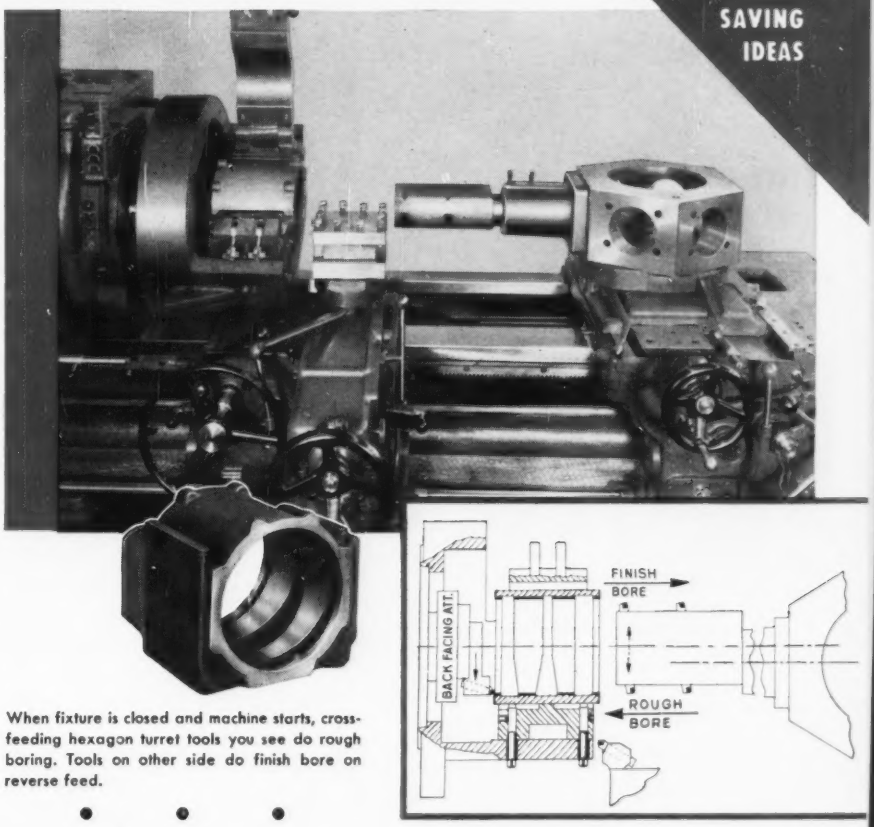
Not every lathe can make such a simple job of work like this: rough and finish boring . . . while simultaneously facing both ends of a part.

This Gisholt 4L Saddle Type Turret Lathe is doing it to these railroad bearing journal boxes. The cast steel workpieces are loaded by crane in the fixture.

The cross-feeding hexagon turret carriage is equipped with solid positive stops on the front and rear which take care of sizing the bore for both the forward feed and reverse feed machining operations. Two tools are on both the front and back of the boring head, thus splitting up the cut.

For rough boring, the hexagon turret is brought forward to the front stop and then fed into the work. When boring is completed, the hexagon turret is moved back to the rear dead stop and fed outward for finish boring. A back facing attachment within the spindle faces one end, and the square turret tool faces the other end.

This unique tooling setup is used for machining 9 different sizes of workpieces with f.t.f. time ranging from 23 to 31 minutes.

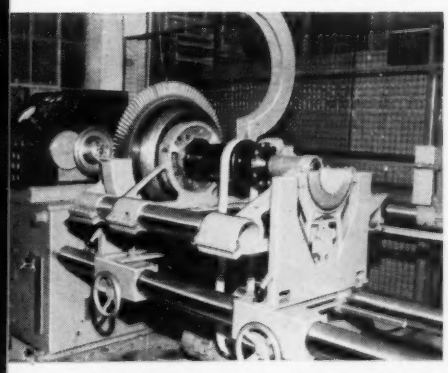


When fixture is closed and machine starts, cross-feeding hexagon turret tools you see do rough boring. Tools on other side do finish bore on reverse feed.

• • •

A SIMPLE SOLUTION TO SPECIAL BALANCING PROBLEM

Gisholt Balancing Machine Locates Dangerous Unbalance in Jet Engine Part



Jet engine turbine rotor assembly ready for precision balancing. Shroud is lowered over rotor during balancing operation.

Gisholt Balancing School—offers complete courses in theory and practical application of balancing to help with your particular problems. For complete details, starting dates, write today.

Unbalance causes vibration, and vibration means trouble. Bad trouble in the case of this jet engine turbine rotor assembly if it were allowed to remain. That's why precision balancing is such an important part of production.

A Gisholt DYNETRIC 3UJP Balancing Machine is used for dynamically balancing every assembly. Placed in a special cradle, the unit is rotated on its own bearings. Shrouding is provided to reduce air load.

Taking direct readings from the machine, the operator quickly corrects unbalance by adding steel weights in a balance-ring groove machined on the outside face of the turbine wheel for the left correction plane—and by adding washers to bolts for the right correction plane. The result is balance of unbelievably low tolerances, completely smooth operation.

Precision balancing can make your rotating parts and products better performing . . . and more lasting. Gisholt balancing equipment is adaptable for virtually every balancing problem.

Providing balancing correction facilities in the original design speeds up this vital balancing operation.

DYNETRIC BALANCERS — GISHOLT

DEVELOPED JOINTLY WITH WESTINGHOUSE ELECTRIC CORPORATION
"DYNETRIC" IS A TRADE MARK REG. U. S. PAT. OFFICE BY WESTINGHOUSE ELECTRIC CORPORATION

There is full information in the booklet, GISHOLT BALANCING MACHINES. Ask your Gisholt representative, or write direct for your copy.

GISHOLT

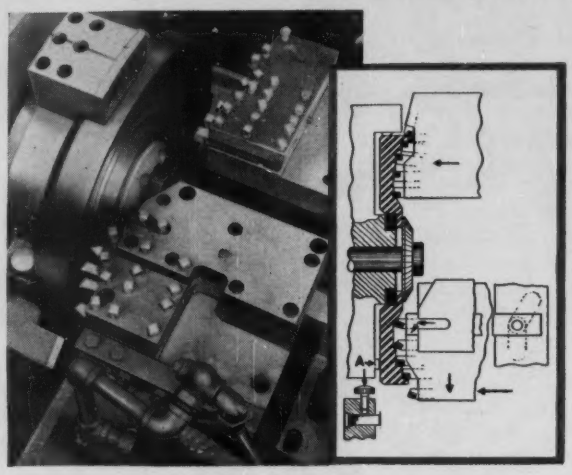
TIME-SAVING IDEAS

BUNCHING UP OF CUTS FINISHES LARGE PARTS FAST

Simplimatic Pulls 11 Tools at Once to Cut Costs!

These large steel flywheels require boring and facing on several diameters—plus special angle facing. The best approach to the problem was found in the Gisholt Simplimatic Automatic Lathe. This permitted combining all operations in one setup.

The 19" flywheel is held by an air-operated drawback fixture. The job starts with tools on the front slide being table fed to cutting position. Normal slide movement then carries the tools away from the spindle centerline, finish facing three step faces and the rim face. The hub angle is finish faced with a tool held in a sliding tool holder mounted inside the main tool block and controlled by a special cam. Tools on the rear slide finish bore three co-bores, finish turn the hub and chamfer the rim O.D. and I.D. A total of eleven tools works simultaneously to finish this part in just 5.60 minutes f.t.f.



Tooling setup for machining flywheels. "A" shows spring jack for supporting edges of workpiece and preventing chance of distortion.

Close-up shows tooling arrangement on front and rear slides and sliding tool holder mounted inside the main tool block.

Straight and angular facing, plunging and facing, turning, boring and chamfering . . . all these cuts are taken simultaneously on the Simplimatic Automatic Lathe with speed that means minimum costs.

• • •

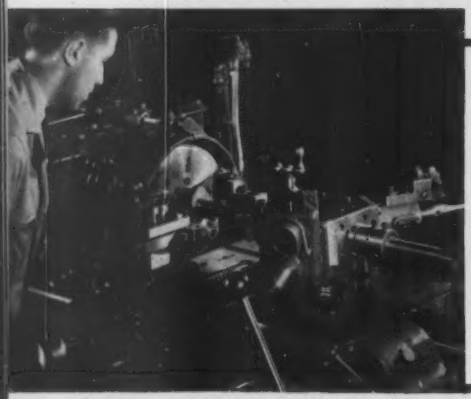
CHUCKING RING SAVES SECOND OPERATION

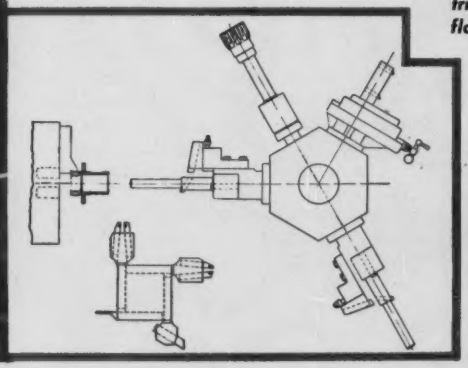
Gisholt Ram Type Turret Lathe Speeds Turning and Boring Work

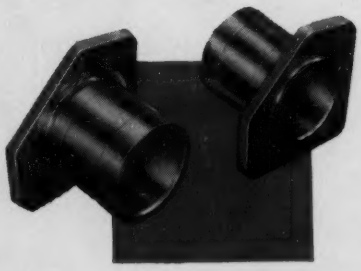
Machining these bearing support bushings would normally be a two-operation job. But it isn't, because of the addition of a chucking ring to the casting. It's a case of the slight value of the cut-off stock being more than made up by savings in time and greater accuracy.

Tools on the hexagon turret bore, turn, face, ream and chamfer. At the same time, tools mounted in special double tool holders on the square turret rough and finish straddle-face the flange, form the O.D. relief and cut off to length. Time is only 3.5 minutes f.t.f.

By leaving a chucking ring on the workpiece, a second operation is eliminated, concentricity is assured as is parallel facing of flange. Saves machining time, too.







No. 9-1054
629

THE GISHOLT ROUND TABLE represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.



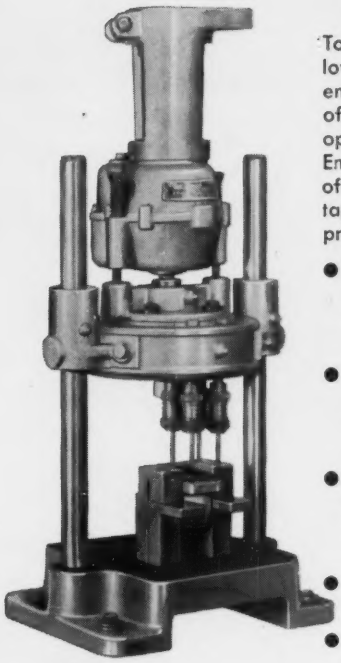
GISHOLT MACHINE COMPANY Madison 10, Wisconsin

TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES

If you tap or drill small parts

you can't afford to be without— **Ettco-Emrick**

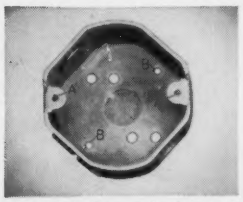
"UNIT-ENGINEERED" MULTIPLE HEADS



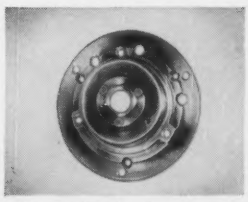
To put your small parts tapping and drilling on a low-cost, mass production basis you need specially engineered methods and equipment. Ettco's years of specialization in this field has led to the development and refinement of the Ettco-Emrick "Unit-Engineered" Multiple Head System, which is one of today's fastest, most economical methods of tapping and drilling small parts. Here's what it provides—

- *Multiple head and work holder engineered as a unit for your specific part to insure fastest handling and production with each stroke of the drill press.*
- *A selection of dozens of different standardized methods of handling a wide variety of shapes and sizes of parts and number and spacing of holes.*
- *Interchangeable tapping and drilling face plates to permit quick, easy changeovers from tapping to drilling — a patented Ettco-Emrick feature.*
- *A design that assures quick, easy installation on any make or model drill press.*
- *A limitless variety of spindle arrangements with capacities ranging from wire sizes to 5/8" in steel.*

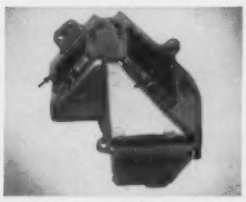
DO JOBS LIKE THESE FASTER, EASIER, AT LESS COST



Steel outlet box with 4 tapped holes. Production—12,800 tapped holes per hour with dual multiple head unit.



54 holes drilled and countersunk in one operation with a multiple head and electric indexing fixture.



Die casting with 6 holes — 3 in each of two planes — automatically positioned and tapped in one operation.

If your small parts production calls for multiple drilling, reaming, countersinking, tapping or threading — it will pay you to check with Ettco. Call in your nearest Ettco-Emrick distributor or send us a sample or drawing for recommendations and estimates.

FOR DETAILS, WRITE FOR BULLETIN No. 3



Ettco-Emrick

ETTCO TOOL CO., INC.

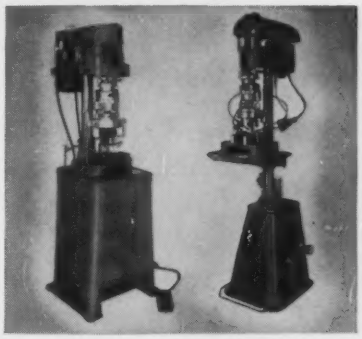
592 Johnson Ave., Brooklyn 37, N. Y.

DETROIT • CHICAGO • WORCESTER • SAN GABRIEL, CALIF.

Dealers throughout the United States and Canada

DRILLING and TAPPING EQUIPMENT NEWS

Tapping Machines Boost Multiple Head Output



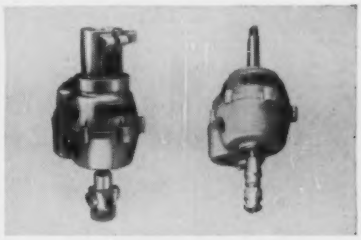
Ettco-Emrick tapping machines are designed for automatic or semi-automatic operation with multiple spindle drilling or tapping heads and single spindle tapping attachments. The No. 72A machine is foot or air-operated. The No. 74 machine is air operated and electrically controlled. *Details in Bulletins No. 72A and No. 74. Write Ettco Tool Co., 592 Johnson Avenue, Brooklyn 37, N. Y.*

Electric Indexing Fixture Has Fast, Precise Action



Ettco-Emrick Indexing Fixtures provide smooth, shockless, positive action. Can be used on any machine base. Synchronization of index fixture with outside machine member is electrically controlled. Utilizes interchangeable nesting plates ranging from 10" to 14" in diameter. *Details in Bulletin No. 97. Ettco Tool Co., Inc., 592 Johnson Ave., Brooklyn 37, N. Y.*

Tool Up Any Drill Press For Fast, Accurate Tapping



Ettco-Emrick tapping attachments can be mounted on any drill press. Newly patented friction clutch provides the delicate sensitivity needed for high speed tapping or threading. 7 different models for No. 6 to 5/8" dies and for No. 0 to 1" taps. *Details in Bulletin No. 22. Write Ettco Tool Co., 592 Johnson Ave., Brooklyn 37, N. Y.*



Combine in Palouse Wheat Fields

FPG Photo

BULLARD

The Invisible Background of Industrial Progress

Not too many years ago farming was an occupation of long hours, physical brawn and animal power. Today, however, thanks to mechanical tools and implements, the job of those engaged in agriculture is more productive with less effort and time. This enables the farmers, by and large, to enjoy today's high standard of living and modern conveniences.

Manufacturers of trucks, cultivators, tractors, sprayers, thrashers, spreaders and reapers, just to mention a few, recognize that modern methods and procedures using *Modern Machine Tools* enable them to provide the farmer with these labor-saving, time-saving implements at lowest cost — another example of "The Invisible Background of Industrial Progress."

THE BULLARD COMPANY • BRIDGEPORT 2, CONNECTICUT



Bullard Mult-Au-Matic

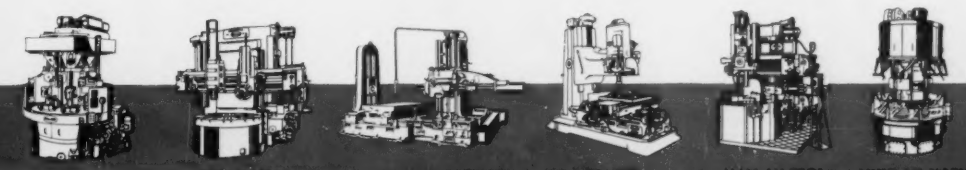
Type "D"–8"–12"–16" with 6 or 8 Spindles, Type "D" 16–23 and Type "K" 6 Spindles and 6 twin Spindles, 8 Spindles and 8 twin Spindles.

Are you interested in reliability and flexibility of the machine tools in your plant? Then examine your needs in the light of the experience of a nationally known manufacturer and user of Mult-Au-Matics. Here is what they report on Bullard Mult-Au-Matics:

Reliability — Machines operating 24 hours a day, 5 days a week. Four other departments depend on parts machined on Bullard Mult-Au-Matics to maintain their production schedules.

Flexibility — Machine a wide range of parts including gears, carriers and nozzles of a great variety of materials up to 365 Brinnell hardness. Do in one fast machining cycle what may require two or three longer operations on a horizontal turret lathe.

These productive, time-saving, cost-reducing features can be applied to your machining problems. A Bullard Sales Engineer will cheerfully review them with you — call him or write to The Bullard Company, Bridgeport 2, Connecticut — phone EDison 6-2511.



BULLARD

WELDING IS EASIER WITH

HELIARC

Trade-Mark

TORCHES



HW-9
for light welding
Air-cooled—
75 amp. a.c.h.f., d.c.s.p.
Electrode sizes:
.020 to 1/16 in.



HW-10
for general welding
Water-cooled—
300 amp. a.c.h.f.,
d.c.s.p., d.c.r.p.
Electrode sizes:
.040 to 1/8 in.

WELD ALL THESE METALS WITHOUT FLUX

aluminum
magnesium alloys
stainless steel
HASTELLOY alloys
Everdur alloys
cast iron
MULTIMET alloys
brass and bronze
copper
Inconel alloy
mild and low-alloy steel
silicon-copper alloys
nickel and nickel-base alloys
silver and silver-cladding



HW-12
for heavy-duty welding
Water-cooled—
500 amp. a.c.h.f.,
d.c.s.p., d.c.r.p.
Electrode sizes:
.040 to 1/4 in.

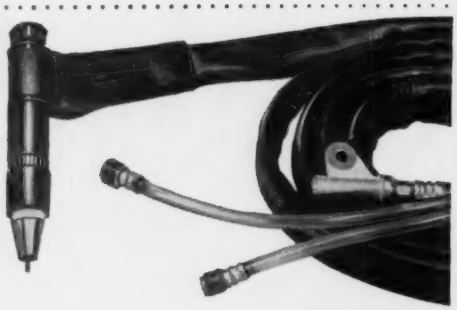


HW-8
for spot-welding
Water-cooled—
250 amp. a.c.h.f., d.c.s.p.
Electrode sizes:
1/8 to 5/32 in.

HIGHEST WELD QUALITY

GREATEST WELDING SPEED

MINIMUM WELD FINISHING



HW-13
for mechanized welding
Water-cooled—
500 amp. a.c.h.f., d.c.s.p.
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Linde Air Products Company
A Division of Union Carbide and Carbon Corporation
30 East 42nd Street UCC New York 17, N. Y.
Offices in Other Principal Cities
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Division of Union Carbide Canada Limited, Toronto

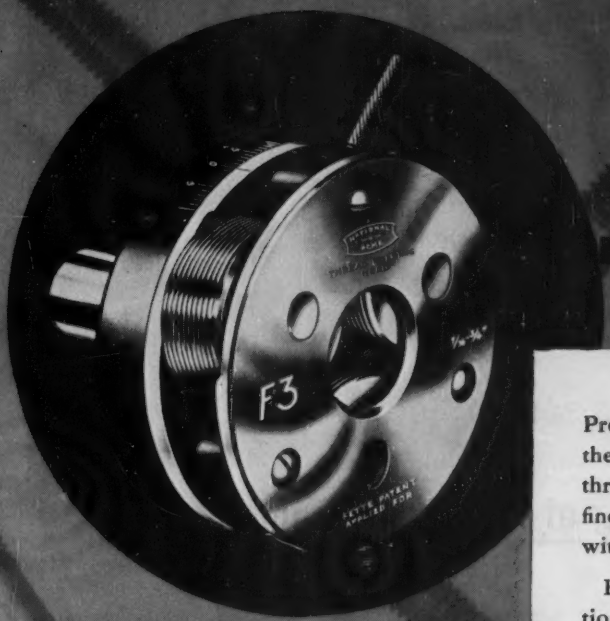
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For more information on products advertised, use Inquiry Card, page 243

how the Aircraft Industry gets better threaded studs...

with NATIONAL ACME "FETTE" self-opening thread rolling heads



rolls threads

FASTER

SMOOTHER

STRONGER

CHEAPER

than any other tool

Precision is a must in the aircraft industry and the threading of studs is no exception. Here, thread specifications call for close tolerances and fine finish in materials that are tough to work with—stainless, high alloy and heat treated studs.

Rolled threads meet the requirements and National Acme "Fette" heads roll 'em at lower cost—save investment in second operation machines and often avoid rehandling because the heads can be applied to primary machining equipment.

These heads generate the thread ahead of the rolls insuring a flow of metal to full thread form without cratering at the crest—smoother, stronger threads with a burnished surface. And rolling speeds are the same as turning speeds with high speed tools.

Bulletin FRH-53 shows specifications of the six head sizes —1/16 to 3/4" in non-revolving type head, 7/16 to 1" revolving type—or, ask your engineers to talk with ours.

The NATIONAL ACME COMPANY

170 EAST 131st STREET • CLEVELAND 8, OHIO

Acme-Gridley Bar and Chucking Automatics: 1-4-6 and 8 Spindle • Hydraulic Thread Rolling Machines • Automatic Threading Dies and Taps • Limit, Motor Starter and Control Station Switches • Solenoids • Contract Manufacturing

THE LONG VIEW



on the buying and leasing of industrial equipment

JONES & LAMSON'S 3-WAY MARKETING SERVICE

To further facilitate the expansion of American productivity and markets, Jones & Lamson now offers *three* plans for the procurement of machine tools.

They are designed to accommodate the widest possible variety of industrial needs, and to establish top industry standards for sound practice.

Outright Purchase

The outright purchase of capital equipment is generally preferred. It offers the obvious advantages to the user of lower cost, freedom of operation, and full profit from the use of the equipment.

"Pay-from-Productivity" Plan

Plans are also offered for those who prefer making payments from the additional savings created by the use of new and modern machine tools, and on terms more favorable than can be obtained from most credit sources.

Payments may be made on a one to five year basis, in equal monthly installments, with a small down payment and a charge at the rate of 3.25 percent on the original unpaid balance.

(Payment Analysis per $1,000. Sixty Equal Monthly Payments)

	Remaining Principal	Total Payment During Year	Total Cumulative Payments
Payment at Shipment	—	—	250.00
End of 1st year	600.00	190.89	440.89
End of 2nd year	450.00	181.89	622.78
End of 3rd year	300.00	172.89	795.67
End of 4th year	150.00	163.89	959.56
End of 5th year	None	154.89	1,114.45

The Lease Plan

Leasing may be advantageous when working capital is inadequate for necessary plant modernization or expansion, and when alternative uses of capital are more pressing or more profitable.

Under the Jones & Lamson plan, the customer gets the normal 1 year guarantee, and he may offer to buy the machine at the end of any year, at the then existing fair market value or at a predetermined option price.

To provide maximum flexibility, the plan is available in four variations, the principal differences being in the annual rental and return charges. With each plan, a 10 percent deposit is required, to be refunded to customers upon fulfillment of transaction. The minimum payment plan is shown below.

(Annual Rental per $1,000 Selling Price)

Year	Rent	Return Charge
1st	$180	$500
2nd	180	360
3rd	180	240
4th	180	120
5th	180	None
6th	180	None
7th	60	None
8th	60	None
9th	60	None

JONES & LAMSON MACHINE COMPANY

512 Clinton St., Springfield, Vermont, U. S. A.

Turret Lathes — Fay Lathes — Thread & Form Grinders — Optical Comparators — Threading Dies

For more information on products advertised, use Inquiry Card, page 243

• Contract Manufacturing

WE CAN'T SHOW ALL OF THEM,
but, we make them



Many years ago, our founder made the remark:
"Gears we can't make ain't"
frankly that homespun phrase aptly expressed our position *then*, and even more so *now*.

Long ago, we realized that no one type of gear could be a "cure-all" for every problem — so, we decided to install the *most modern equipment available;* machines for not only cutting every type of gear, but also for machining, finishing, heat treating, hardening and testing gears.

Today, 62 years since our inception, we possess one of the largest, best equipped gear plants in the World.

You can be positive, if you buy from "Phillie Gear."

Spur
Helical
Spur Internal
Helical Internal
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Philadelphia Gear Works, INC.



ERIE AVE. AND G ST., PHILADELPHIA 34, PA.
NEW YORK • PITTSBURGH • CHICAGO • HOUSTON • LYNCHBURG, VA.

Industrial Gears and Speed Reducers
LimiTorque Valve Controls

Test cuts

by accurate performance of



Photos courtesy
Brown-Wales Company,
Cambridge, Mass.

CINCINNATI

THE CINCINNATI SHAPER CO.

CINCINNATI 25, OHIO, U.S.A. SHAPERS • SHEARS • BRAKES

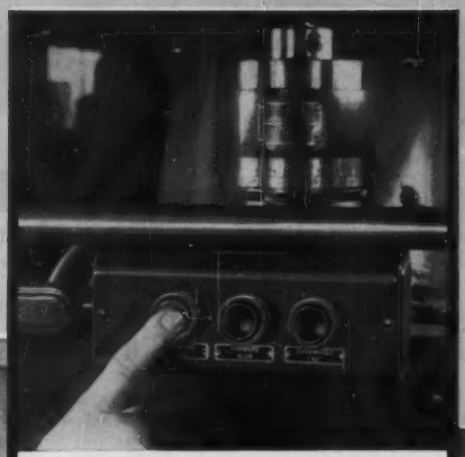
eliminated CINCINNATI Shears...

Brown-Wales Company says:

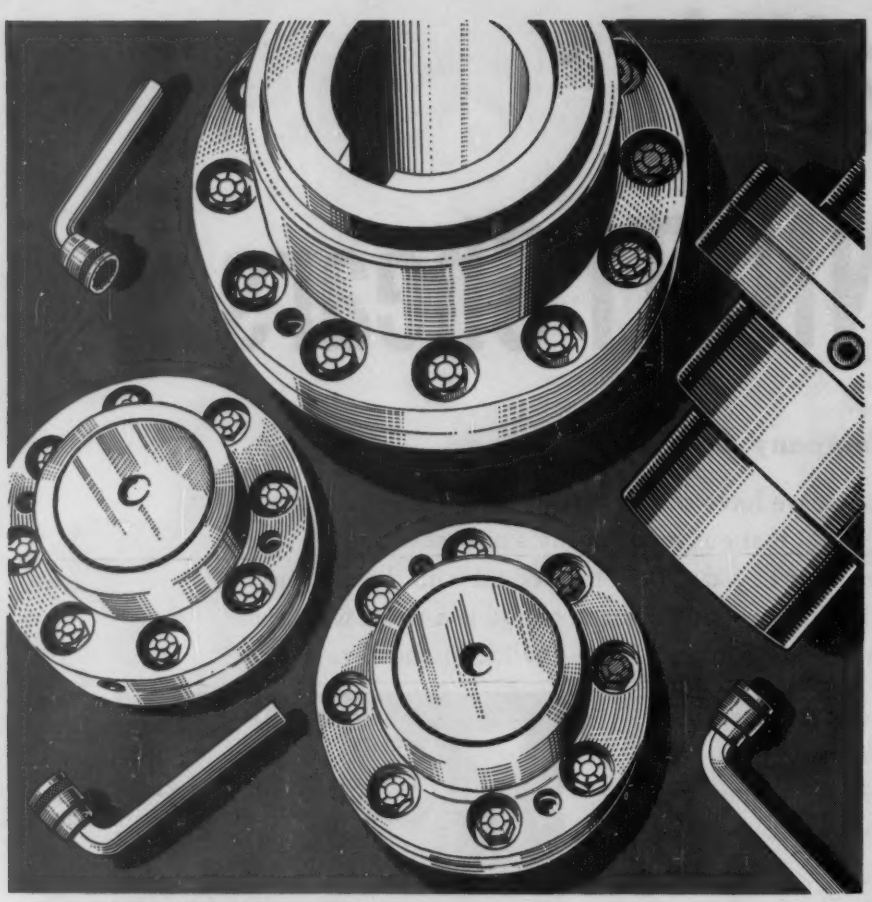
"As a steel warehouse, we have comparatively few production jobs, however, we have found that our men with this new shear can turn out far more work in an hour or a day than they could with the old one. In the first place, the power operated back gauge is a great time-saver when changing, as we frequently do, from one job to another.

"Secondly—the greater accuracy of the shear has made test cuts unnecessary, so that down time between runs is greatly reduced."

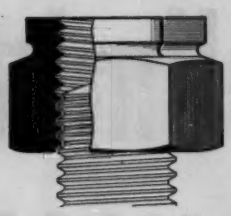
Write for Shear Catalog S-6.



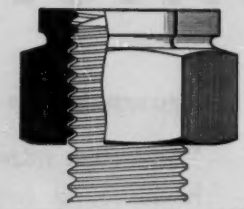
The Buttons that save time. The great time-saver—the Cincinnati front controlled Power Back Gauge.



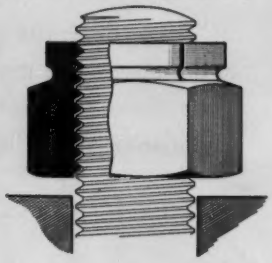
Manufacturers of couplings like these find that FLEXLOC Self-Locking Nuts provide faster assembly and safer, more dependable locking than is afforded by most other methods.



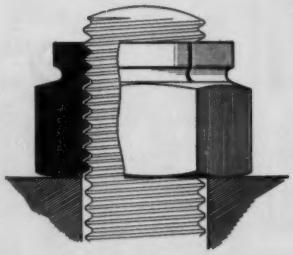
Starting. A FLEXLOC starts like any ordinary nut. Put it on with your fingers. Tighten it with a standard hand or speed wrench.



Beginning to Lock. As the bolt enters the segmented locking section, the section is expanded, and the nut starts to lock.



Fully Locked As a Stop Nut. When 1½ threads of a standard bolt are past the top of the nut, the FLEXLOC is fully locked. A FLEXLOC does not have to seat to lock.



Fully Locked As a Seated Nut. When it is used as a lock or stop nut, the locking threads of the FLEXLOC press inward against the bolt, lifting the nut upward and causing the remaining threads to bear against the lower surface of the bolt threads. Vibration will not loosen a FLEXLOC, yet there is no galling of threads.

Here's why more and more original equipment manufacturers specify FLEXLOCs

Whether it's on power transmission couplings or on access doors of helicopters, more and more FLEXLOC Self-Locking Nuts are being used to insure positive fastening of assemblies.

There are many reasons for this. FLEXLOCs reduce production costs. They are easy to install. They are one piece, all metal—nothing to assemble, come apart, lose or forget. They eliminate complicated, time-consuming methods of locking bolts and studs. They stay put—once their locking threads are fully engaged, they won't work loose. They are easy to get—SPS can make prompt delivery of FLEXLOCs in any quantity, and in a wide range of sizes, through a national organization of industrial distributors. Write for literature and samples. STANDARD PRESSED STEEL CO., Jenkintown 19, Pa.

FLEXLOC® LOCKNUT DIVISION

SPS
JENKINTOWN PENNSYLVANIA

For more information on products advertised, use Inquiry Card, page 243

heavy jump cut job now turned 4 times faster

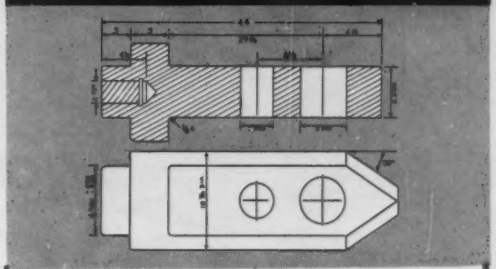


on Axelson 25" Heavy Duty Lathe

Tough 4140 steel forgings for 300 ton oil drilling hooks having ⅜" to ⅞" stock and a severe interrupted cut are now turned FOUR TIMES FASTER on Axelson Heavy Duty Lathes, using Kennametal tools. These forgings brinell 311 and weigh 800 lbs. before machining and are only one of twelve different size drill hooks manufactured. More than eight hundred drill hooks have been turned on this Axelson 25" heavy duty lathe since 1945 and it is reported that "no excess machine wear has been experienced and the machine stands up very well." It is also interesting to note that the work is supported on the tail stock by a live center having a #6 morse taper shank.

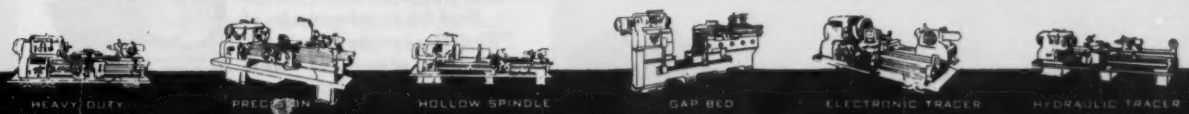
Axelson lathes are built to stand up to this heavy type work and at the same time will produce to precision tolerances day in and day out. It will pay you to look to Axelson for recommendations on turning problems whether they are heavy duty, high production, or precision. Your welcome request for assistance is without obligation.

Write for literature describing Axelson Heavy Duty Lathes, models B-16", W-20", D-20", E-25", F-32", Precision Tool Room Lathes models 16, 20, or any of the models shown below. 6150 Boyle Avenue, Los Angeles 58, California.



PERFORMANCE DATA

Part	300-Ton Drill Hook
Machine	Axelson 25" Heavy Duty Lathe
Number of Pieces	3 per lot (one of 12 sizes)
Material	S.A.E. 4140 Forging weighing 800 lbs.
Hardness	311 Brinell
Depth of cut	⅜" to ⅞"
Greatest Precision	+.000,—.006
Tool Material	Kennametal 17° lead angle. Tool is set on its side for a 17° negative back rake and 7° positive side rake. The tool post is turned for a 10° lead angle.
Feed	.033" per rev.
Speed	207 SFM
Floor to Floor Time	Approximately 3 hours.
Note	Formerly H.S.S. cutters were used.

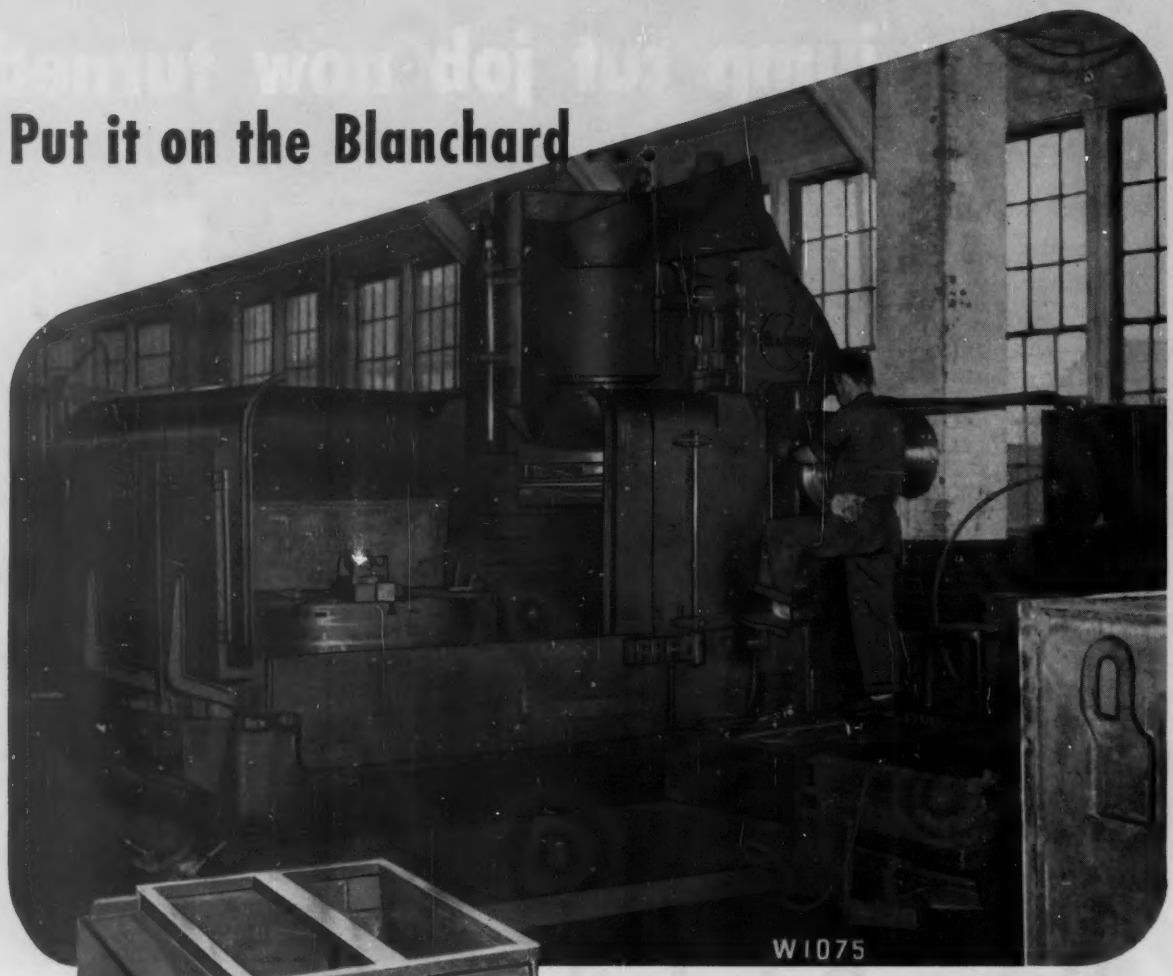


AXELSON MANUFACTURING COMPANY DIVISION
PRESSED STEEL CAR COMPANY, INC.
LOS ANGELES 58, CALIFORNIA

PSC

RAILROAD FREIGHT CARS • STANDARD PARTS • DAIRY & FARM EQUIPMENT • WASTE CONTAINERS • STAINLESS STEEL COOKWARE • CAR ACCESSORIES • TANKS • AGITATORS • SMOKE STACKS • DUST COLLECTORS • COAL & ASH HOPPERS • FITTINGS & ELECTRICAL ACCESSORIES • ORDNANCE MATERIEL • UNISHELTER RELOCATABLE HOMES • EXPORT ONLY: LOCOMOTIVES & TRACKWORK • CARS (MINE, ORE, CANE, INSPECTION) • UNISTRUT METAL FRAMING • OILED BURNERS • BRICK & TILE MACHINERY • CANE LOADERS

Put it on the Blanchard





it takes 1/5th the time!

Here is another example of the special jobs Blanchard Surface Grinders perform *in less time,* to exacting specifications.

These explosion-proof control cases are used in the coal mining industry. Each steel weldment case is 36" x 48" x 24" deep. Because gaskets cannot be used, surface finish, and flatness must provide a dust and gas explosion-proof metal seal.

A Blanchard Surface Grinder, the No. 32-60, removes approximately ⅛" of stock – in *one-fifth* the machining time formerly required.

Send a sampling of your parts for free test grinding and our recommendations.



Send for your free copies of "Work Done on the Blanchard", fourth edition, and "Art of Blanchard Surface Grinding".

PUT IT ON THE BLANCHARD

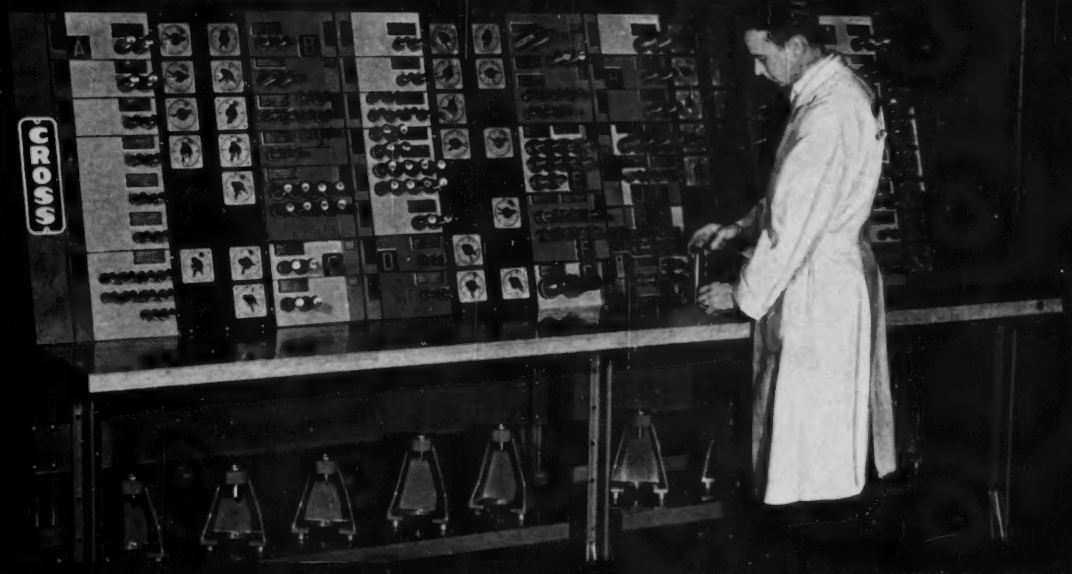
THE BLANCHARD MACHINE COMPANY

64 STATE ST., CAMBRIDGE 39, MASS., U.S.A.

For more information on products advertised, use Inquiry Card, page 243

A Mechanical Eye to Watch Your Tools

Cross Machine Control Units Reduce Downtime and Tool Costs



(U.S. Patent Nos. 2679038 and D-163935. Others Pending.)

The Machine Control Unit was originated by Cross to solve tool changing and downtime problems in machines with multiple tooling.

Available for drilling, milling, boring, turning and similar machines, the Control Unit provides many benefits:

- ★ **It reduces tool expense by minimizing breakage and grinding.**
- ★ **It is equipped with Toolometers which automatically stop the machine when tools need changing.**
- ★ **Other tools indicated by the Toolometers as *almost* used up are replaced at the same time. This grouping of changes drastically reduces downtime.**
- ★ **Pre-set tools are stored in the Machine Control Unit for instant availability at the machine.**
- ★ **Standard fixtures and gages are provided for pre-setting the tools to eliminate downtime for machine adjustments and trial cuts.**

Over 300 Cross Machine Control Units are now successfully reducing manufacturing costs in plants throughout the country. It will pay you to write, wire or phone for full information *today*.



Master tool setting fixtures and two standard types of gages for pre-setting tools.

Established 1898

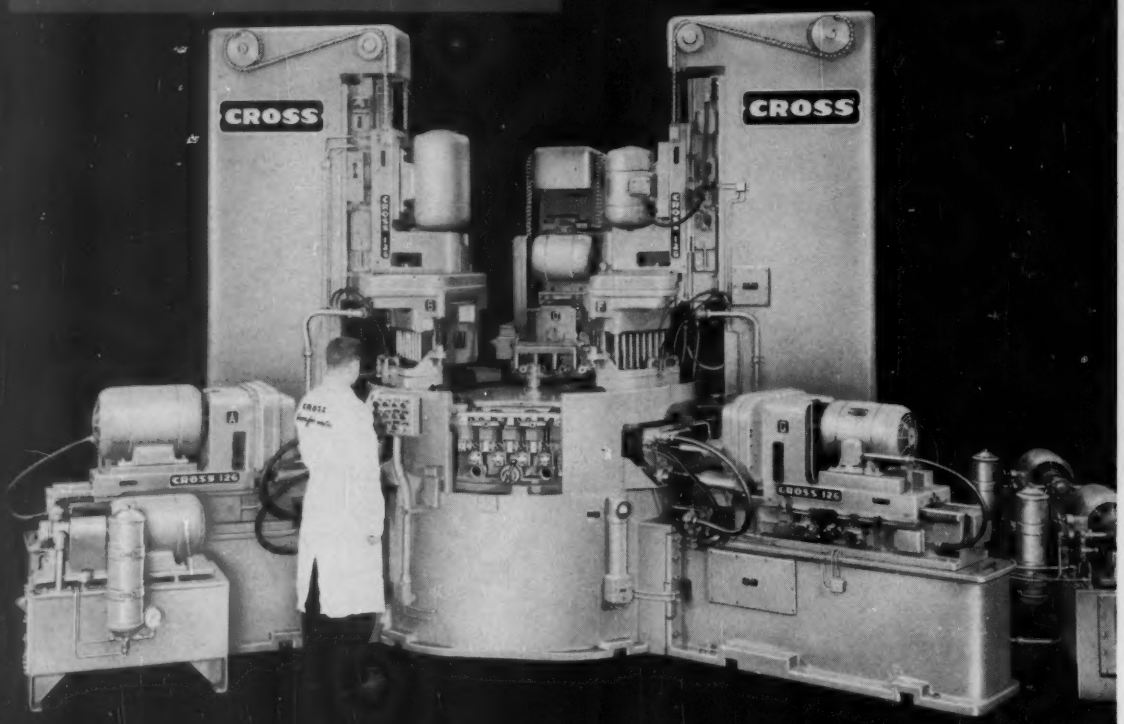
THE CROSS CO.

DETROIT 7, MICHIGAN

***Special* MACHINE TOOLS**

Drills, Reams, Chamfers, and Mills Connecting Rods

Another Special by Cross





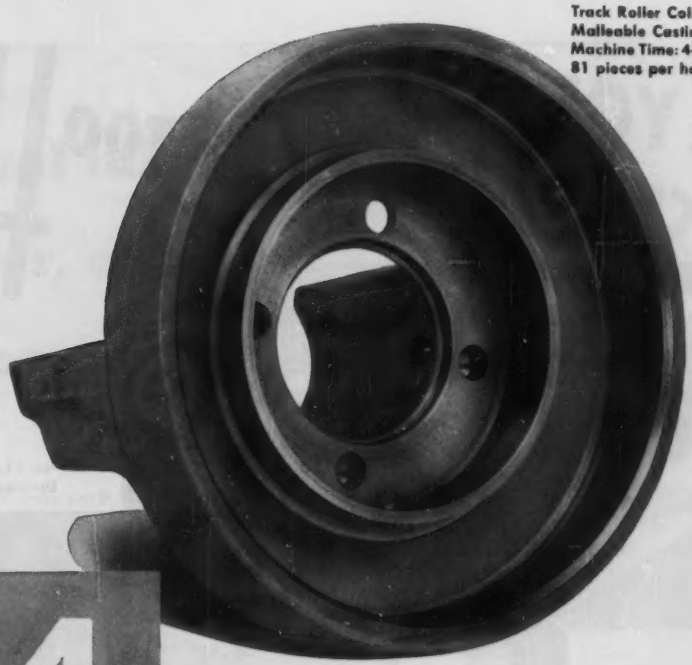
- ★ 450 pieces per hour at 100% efficiency.
- ★ 6 stations: 1 for loading, 2 for drilling, 1 for chamfering, 1 for milling, and 1 for reaming.
- ★ Drills, reams and chamfers bolt holes; drills, reams and chamfers piston pin hole; and mills lock slot.
- ★ Fluid motor driven index table.
- ★ Hydraulic power clamping for work holding fixtures.
- ★ Other features: Hardened and ground ways; coolant system; hydraulic feed and rapid traverse; construction to J.I.C. standards.

Established 1898

THE CROSS CO.

DETROIT 7, MICHIGAN

Special MACHINE TOOLS



Track Roller Collar
Malleable Casting
Machine Time: 44 Seconds—
81 pieces per hour.

17 operations in 44 seconds

...that's 81 pieces per hour, or 4 TIMES FASTER than by the former method...

on an ACME-GRIDLEY 8-spindle 8" chucker

Speaking of "plant automation"—how better can the modern practice of it begin than on machining methods that complete ALL the operations on intricate parts in a single predetermined cycle, in a cycle time that avoids toting the job from one machine to the next, eliminates costly manhours, investment in secondary operation machines, releases valuable floor space?

On the job shown, or any other which is "automized" through multiple spindle planning, ingenious and sound tooling of the machine to include ALL the operations in the least time becomes a matter of vital importance.

This is where the unparalleled experience of our tool Engineers wins and holds preference for Acme-Gridley bar and chucking automatics—in hundreds of shops.

Whether your chucking work calls for 4, 6 or 8 spindles, whether 4 or 20 different operations, it will pay you to look at our proposal.

REMEMBER: *No industry can do* **TODAY'S** *job—with* **YESTERDAY'S** *tools—and make a profit* **TOMORROW.**

The NATIONAL ACME COMPANY

170 EAST 131st STREET • CLEVELAND 8, OHIO

ACME-GRIDLEY BAR and CHUCKING AUTOMATICS
1-4-6 and 8 Spindle • Hydraulic Thread Rolling Machines • Automatic Threading Dies and Taps • Limit, Motor Starter and Control Station Switches • Solenoids • Contract Manufacturing

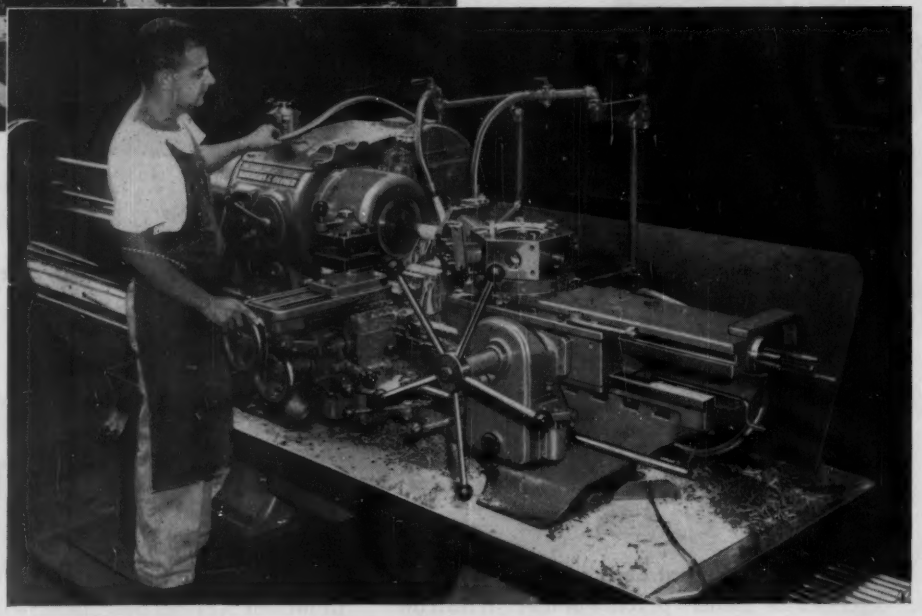
ARE YOUR MACHINE TOOL COSTS TOO HIGH?



No. 7 Lathe installed at the large Florida Division Plant at Lakeland, Florida.



Write for Catalog covering specification on the No. 7 Lathe



fmc

Food Machinery & Chemical Corporation takes the "BITE" Out of Machine Tool Costs...

Mr. Howard L. Shannon, Division Manager, Florida Division of Food Machinery and Chemical Corporation says, "The one factor which particularly influenced our selection of Bardons & Oliver equipment was the availability of a machine capable of handling a 4½" diameter bar through the head stock with a reasonable capital investment. In our shop our loading is normally comparatively light, which makes it difficult for us to justify a heavy fixed investment in tools, and in this machine we were able to procure a new tool with no greater investment than might have been required for a reconditioned tool of comparable capacity in any one of several makes."

MANUFACTURERS OF A COMPLETE LINE OF TURRET LATHES AND CUTTING OFF LATHES

BARDONS & OLIVER, INC.

1135 WEST 9TH STREET • CLEVELAND 13, OHIO

For more information on products advertised, use Inquiry Card, page 243

How Farval lubrication saves labor, eliminates bearing troubles on power shovels

FARVAL—
Studies in Centralized Lubrication No. 156

WATCH a power shovel tear into rock, slate, gravel, or dirt. It's dig, hoist, swing, dump—over and over again, hour after hour, day after day. Work like this soon ruins improperly lubricated bearings. That's why it pays to install the Farval Centralized System of Lubrication on quarry and mine shovels like the one shown.

It takes just a minute or two, even on a big six-yard shovel like the Bucyrus-Erie 150-B, for Farval to lubricate every bearing needing protection for heavy duty. Compare this to stopping the shovel for 15 to 20 minutes each time the operator needs to lubricate by hand—and then he has to climb around looking for grease fittings.

FARVAL FIGHTS FRICTION

Farval delivers any oil or grease that can be pumped under pressure to any number of bearings from one central station, in exact quantities, as often as desired. The rugged Farval valve has only two moving parts—is simple and sure. No uncertain springs, ball-checks or pinhole ports to cause trouble. Any grit, abrasive sand or dust that has penetrated the bearings is forced out by the measured injections of lubricant, and the lubricant forms a protective seal. Hazards due to hit-and-miss hand lubrication are eliminated.

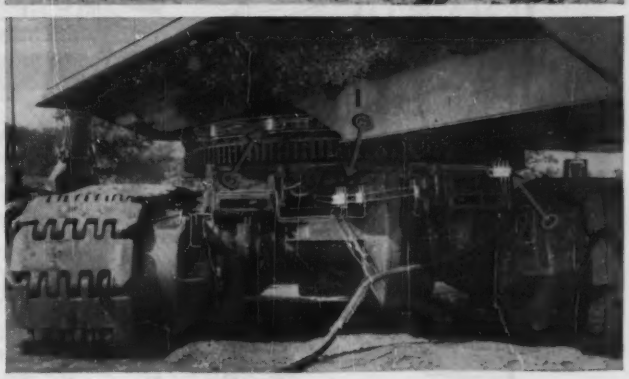
FARVAL SAVES MAN HOURS, LUBRICANT

Experience shows that Farval saves as much as 45 minutes of each hour of oiling labor—up to 3 of every 4 pounds of lubricant consumed by other methods.

If you make or use power shovels, conveyors, crushers, shaker screens, elevators or other heavy equipment, your machines will run longer and produce more if you install Farval. Farval protects millions of bearings throughout industry. Write now for Bulletin 26. The Farval Corporation, 3276 East 80th Street, Cleveland 4, Ohio.

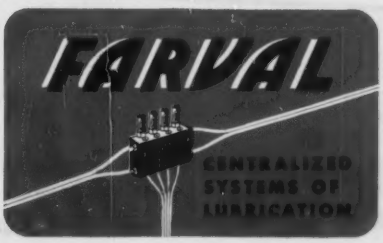
Affiliate of The Cleveland Worm & Gear Company, Industrial Worm Gearing. In Canada: Peacock Brothers Limited.



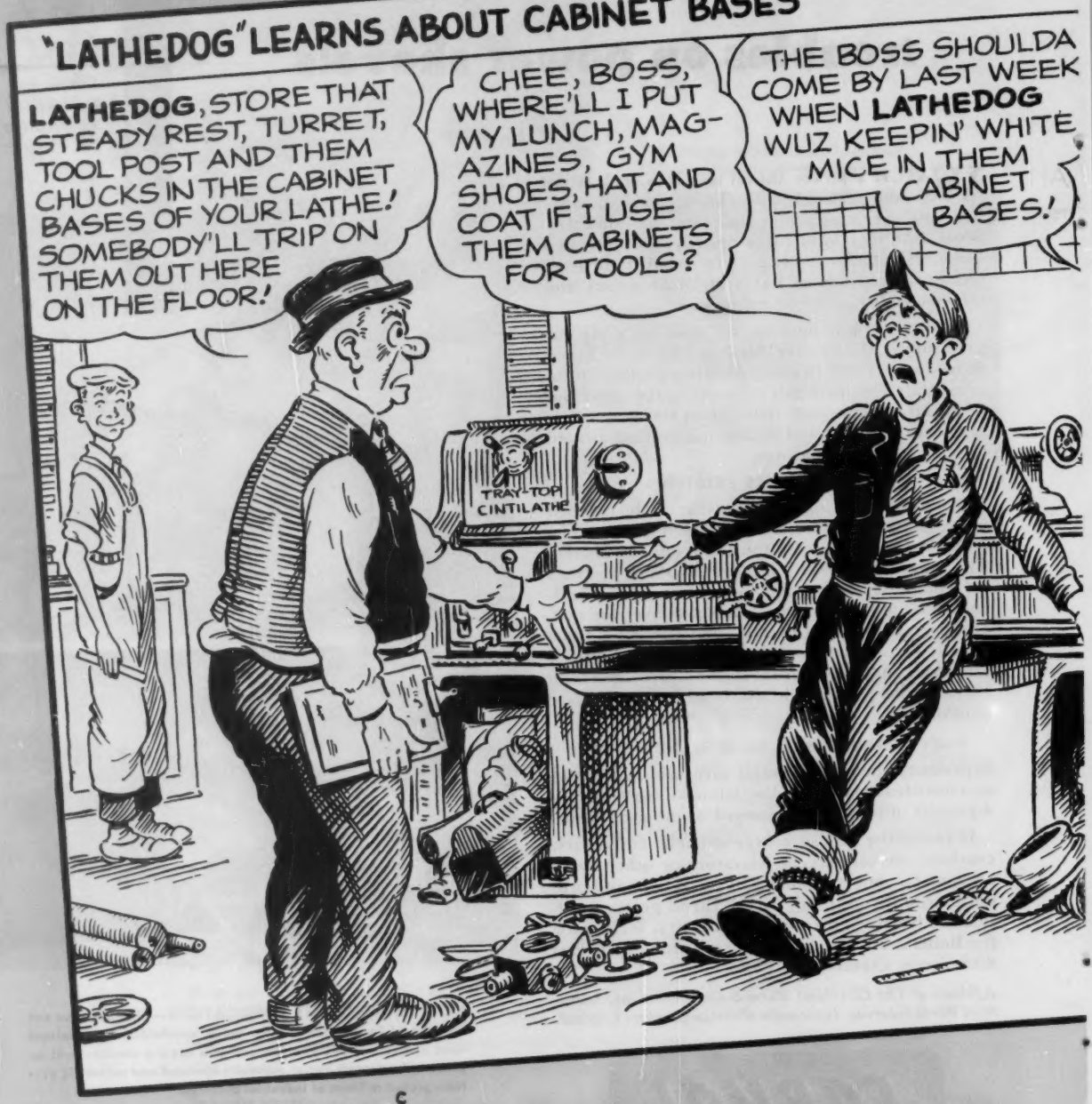


KEYS TO ADEQUATE LUBRICATION—Wherever you see the sign of Farval—the familiar valve manifolds, dual lubricant lines and central pumping station—you know a machine will be properly lubricated. Farval manually operated and automatic systems protect millions of industrial bearings.

Pictured is the Farval-lubricated truck frame of a Model 150-B six cubic yard power shovel. Photo courtesy of Bucyrus-Erie Company.



"LATHEDOG" LEARNS ABOUT CABINET BASES



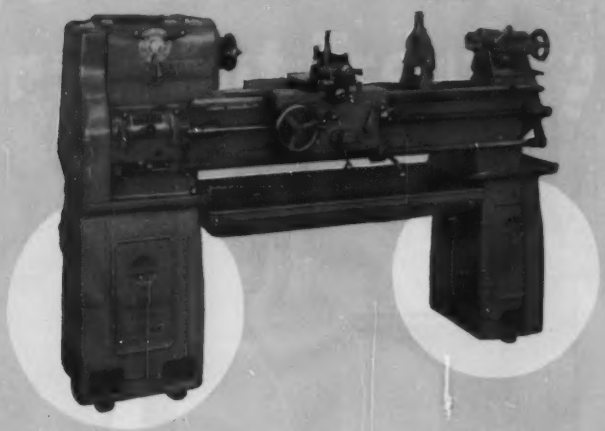
Write for your copy of "Management Facts About Lathes".

center on . . .

cincinnati



Large size prints of this J. R. Williams cartoon are available for framing.



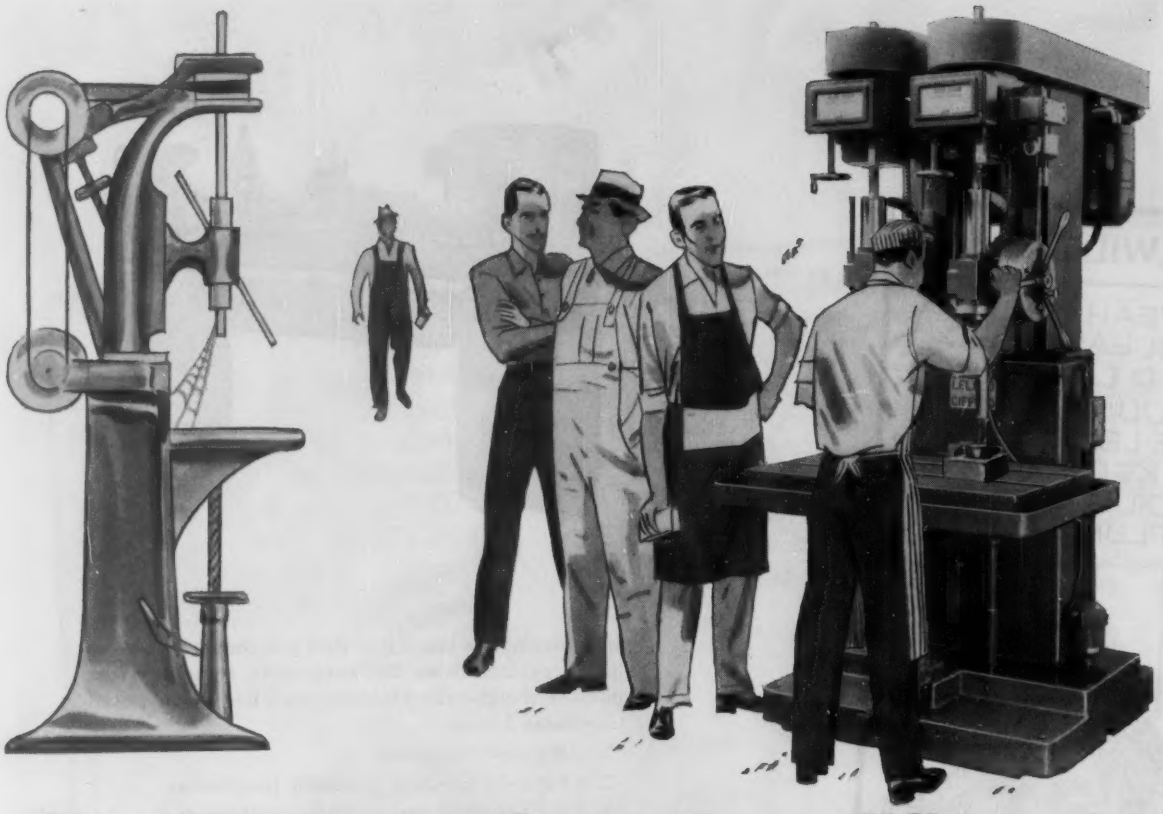
It's amazing the amount of stuff you can store in those handy cabinet bases. But even more amazing is the number of high-priced features you'll find on low-priced Cincinnati Lathes.

1. All geared headstock
2. 12 spindle speeds in geometric progression
3. Direct-reading, speed-shifting mechanism
4. Large spindle mounted in three antifriction bearings
5. Flame hardened gears in headstock, quick change box and apron
6. Cabinet legs with built-in leveling jacks
7. Enclosed quick-change box with lead-screw reverse
8. One shot lubrication of ways
9. Ground ways (flame hardened at extra cost)
10. Tray-Tops on headstock and tailstock
11. Double-walled apron with automatic lubrication
12. Fully enclosed electrical panel, built-in disconnect, transformer, motor and controls (all standard equipment)

We also make a complete line of floor, bench and radial-type drilling machines.

For complete catalogs, prices and name of your local dealer, write on company letterhead to Cincinnati Lathe & Tool Co., 3270 Disney, Cincinnati 9, Ohio.

lathes and drills



It's time to weed out the wallflowers

When operators stand in line to use a new Leland-Gifford Drilling Machine rather than the old belt driven model (it actually happens), it's time to check up.

You'll find plenty of good reasons for their choice. First of all, new Leland-Gifford Machines are easier to use. With convenient central controls, reduced work handling, more speed and built-in safeguards against costly errors, the average operator can *greatly increase machine production* with no more effort on his part. With the added advantage of higher precision, he can do *better* work, too.

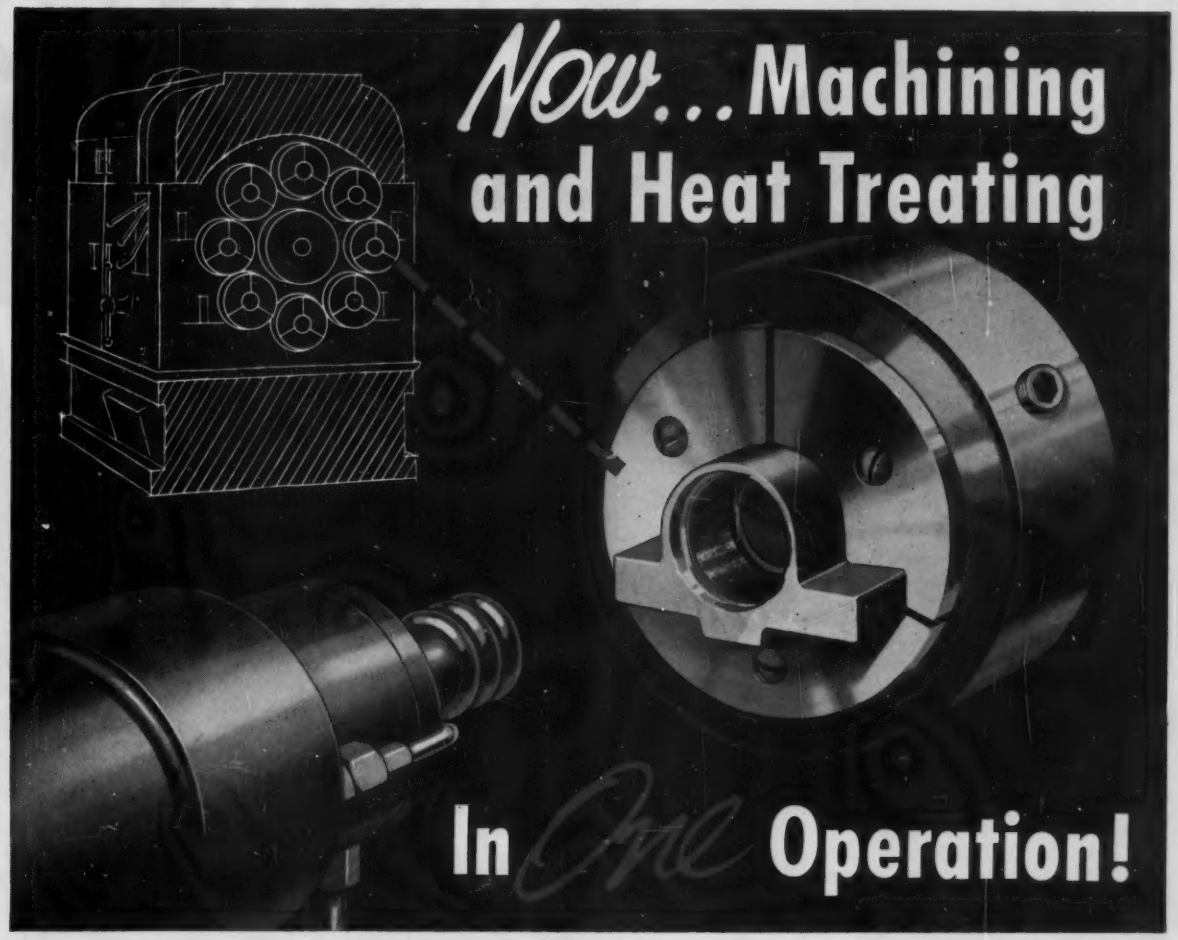
If drilling machines in your plant are turning into "wallflowers", it will pay you to look into the complete line of modern Leland-Gifford Motor Spindle Drilling Machines. Write for complete information or call the office nearest you.

SAVE DAYS — CONTACT THE OFFICE NEAREST YOU

LELAND-GIFFORD
Drilling Machines
WORCESTER 1, MASSACHUSETTS, U.S.A.

- **CHICAGO 45**
  2515 West Peterson Ave.
- **DETROIT**
  10429 West McNichols Rd.
- **CLEVELAND 21**
  P. O. Box 217
- **NEW YORK OFFICE**
  75 South Orange Ave.
  South Orange, N. J.
- **LOS ANGELES OFFICE**
  2620 Leonis Blvd., Vernon 58, Cal.
- **INDIANAPOLIS 6**
  P. O. Box 1051
- **ROCHESTER 18**
  P. O. Box 67, Roselawn Station

For more information on products advertised, use Inquiry Card, page 243



with TOCCO Induction Heating

Mechanics Universal Joint Division of Borg-Warner Corporation now combines automatic heat-treating and metal-working operations on the same machine!

A Tocco Inductor Coil, matched to one spindle of a multiple spindle automatic screw machine, heat treats the inside diameter of automotive trunnion cups—after they have been completely formed on the same machine tool. Twenty-two, 20 and 50 kw, 450,000 cycle TOCCOtron Induction Heating units and 44 automatic screw machines (installed here and in other plants) make up this high-speed production team.

This new method permits the use of SAE 1144 steel and eliminates costly, time-consuming copper plating and carburizing operations formerly required. Heating and quenching cycles total approximately 10 seconds per part, and production is in excess of 300 parts per hour from each machine.

If your products or their components require heat treating, soldering, brazing or forging it will pay you to investigate TOCCO for better, faster ways of producing them at lower unit cost.

THE OHIO CRANKSHAFT COMPANY



TOCCO

Mail Coupon Today

NEW FREE BULLETIN

THE OHIO CRANKSHAFT CO.
Dept. M-9, Cleveland 1, Ohio

Please send copy of "Typical Results of TOCCO Induction Hardening and Heat Treating."

Name_____

Position_____

Company_____

Address_____

City_____ Zone____ State_____

For more information on products advertised, use Inquiry Card, page 243



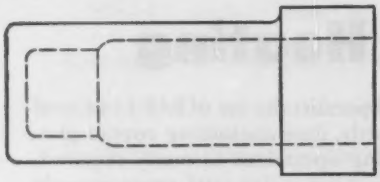
Swaging Success Stories

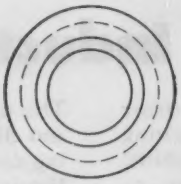
Shaping inside chamber...simplifies machining



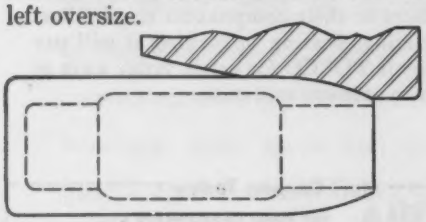


This finished piece with its specially shaped inside diameter presented a problem until Torrington's swaging experts were called in.





They suggested starting with this drilled, reamed and formed blank. Notice that the material at the open end is left oversize.





One swaging operation in dies designed for the job shaped the inside chamber as well as the outside to the desired contour.

Look at these Swaging Economies

1. Swaging is fast—it is ideally suited to mass production of special shapes.

2. Swaging is easy—it can be performed by unskilled labor.

3. Swaging is efficient—it utilizes nearly all the material without waste.

4. Swaging is inexpensive—it eliminates many costly screw machine operations, while giving metal better finish and resiliency.

For more information on swaging as a method for shaping or reducing metals, write for our informative booklet. It describes in detail the Torrington Rotary Swagers that may be able to help you write a "swaging success story" in your own plant.



THE TORRINGTON COMPANY
Swager Department
300 North Street, Torrington, Conn.
Makers of Torrington Needle Bearings

TORRINGTON *ROTARY SWAGING* **MACHINES**

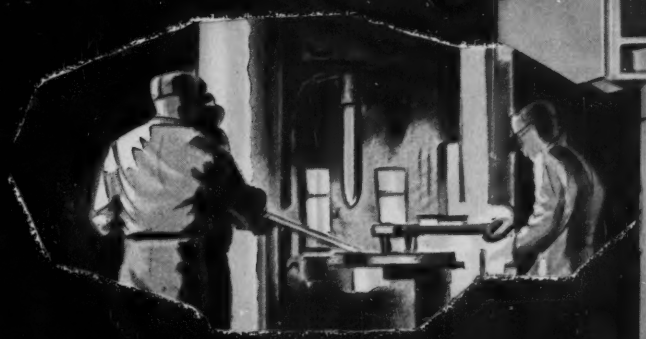
For more information on products advertised, use Inquiry Card, page 243

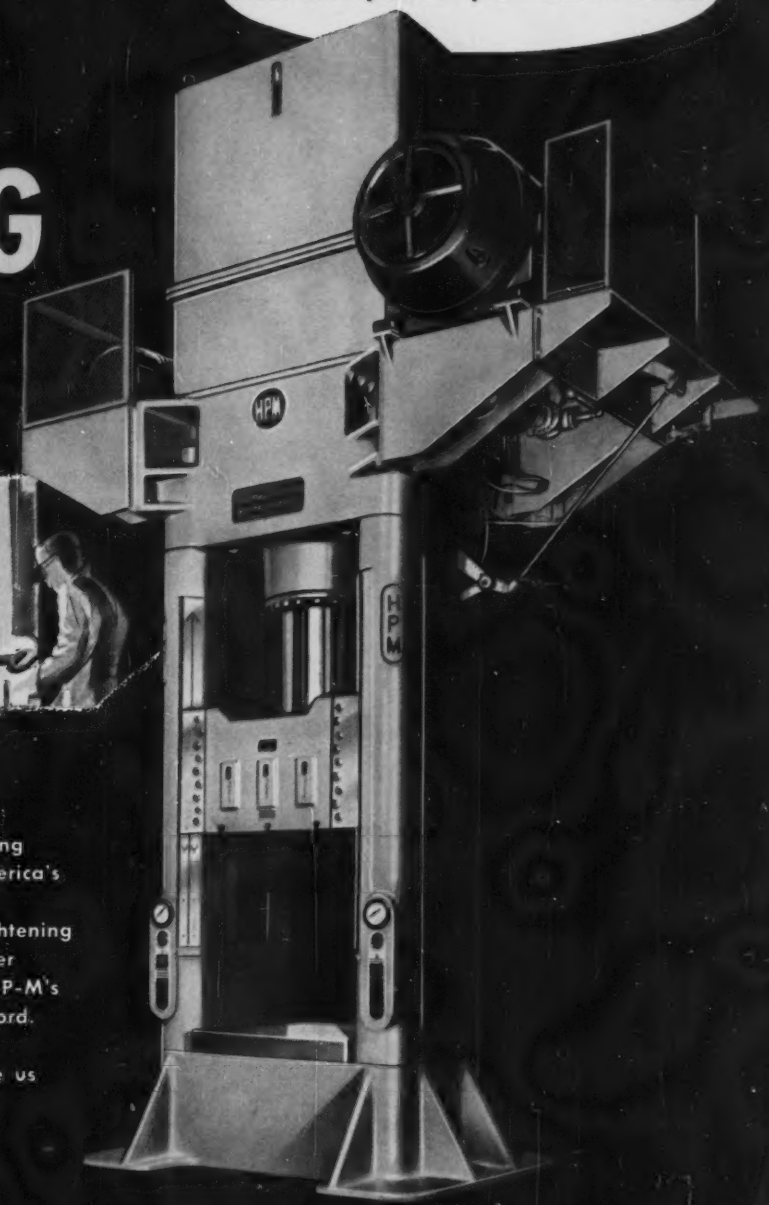
ALL-HYDRAULIC *FASTRAVERSE* PRESSES

SPECIALIZED METAL WORKING

Calls for H-P-Ms

H-P-M FASTRAVERSE Single Action Press with Hydraulic Ejector and Die Cushion





Here, it's H-P-M's recognized experience that pays off! As the leading builder of special presses for America's ordnance industry for shell and cartridge case production, straightening gun barrels, armor plate and many other specialized metal working jobs, H-P-M's performance is a matter of record. Capitalize on H-P-M's 76 years of specialized experience . . . invite us in at the planning stage.

HPM

THE HYDRAULIC PRESS MFG. COMPANY

MOUNT GILEAD
OHIO, U. S. A.

A FEW OF THE HUNDREDS OF USERS OF H-P-M ALL-HYDRAULIC FASTRAVERSE PRESSES

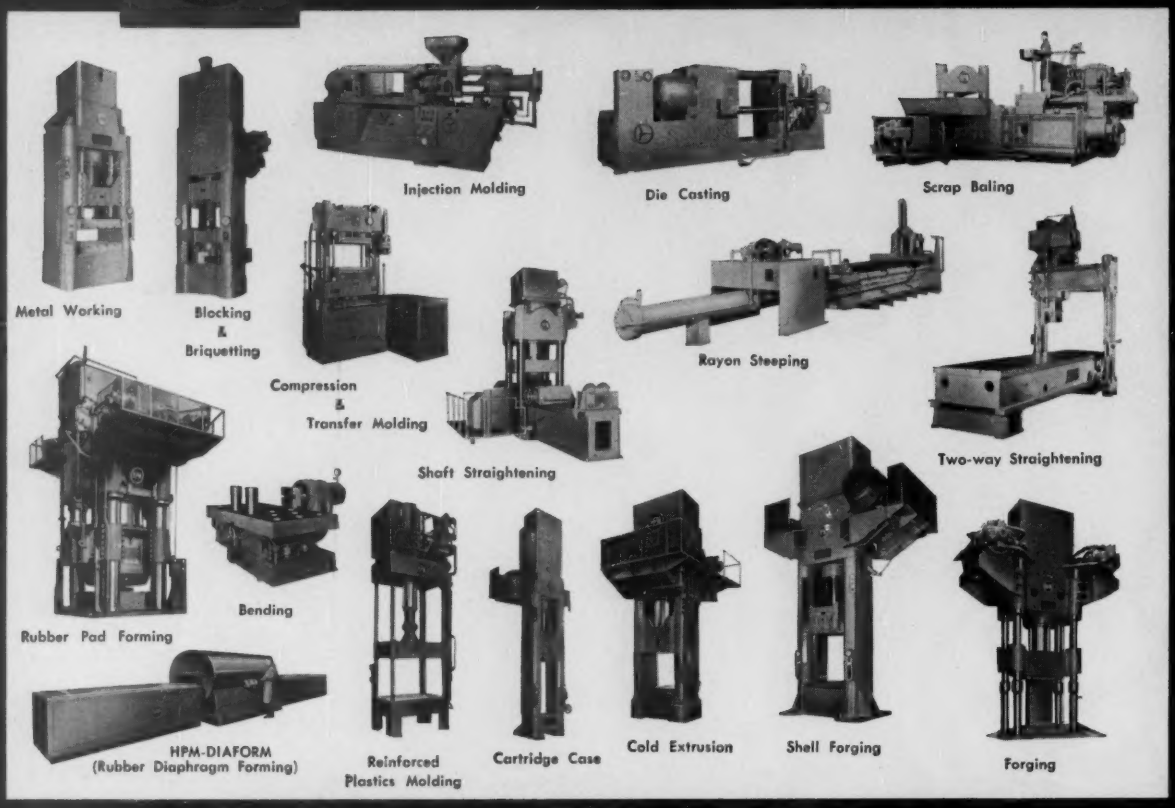
Admiral • Allis-Chalmers • American Locomotive
Boeing • Briggs • Budd Wheel • Buick • Douglas
Caterpillar Tractor • Chevrolet • Chrysler • Goodrich
Consolidated Vultee • Curtiss-Wright • Frigidaire
Ford • General Electric • Westinghouse • Goodyear
General Motors • Hot Point • Hughes Tool • Modine
International Harvester • J. I. Case • Western Electric
John Deere • Lockheed • Massey-Harris • Mullins
North American • Oldsmobile • Oliver • U. S. Steel
Pratt & Whitney • Revere Copper & Brass • Servel
Ryan • Thompson Products • U. S. Rubber • Timken

SEE H-P-M's COMPLETE LINE

For more information on products advertised, use Inquiry Card, page 243

HPM

ALL-HYDRAULIC *FASTRAVERSE* PRESSES FOR EVERY PRESSURE PROCESSING NEED!



HPM HYDRAULIC POWER SYSTEMS

A *NEW* COMPLETE LINE OF HYDRAULIC COMPONENTS!



CYLINDERS
150 P.S.I. Air and 300 to 3000 P.S.I. Oil Hydraulic

VALVES
Directional and Functional, complete range to 3000 P.S.I.

PUMPS & MOTORS
Fixed and Variable Displacement to 3000 P.S.I.

POWER UNITS
Complete power packages for every application.

ACCESSORIES
Items to complete that hydraulic circuit.

WORLD-WIDE SALES ENGINEERING COVERAGE

H-P-M DOMESTIC OFFICES
CHICAGO 45, ILLINOIS
DETROIT 2, MICHIGAN
MOUNT GILEAD, OHIO
TEANECK, N. J.
PITTSBURGH 22, PA.

DOMESTIC REPRESENTATIVES
ATLANTA, GEORGIA
Chandler Machinery Co.
BIRMINGHAM 3, ALABAMA
Quinn, McKerall & Quinn
CAMBRIDGE 42, MASS.
Austin Hastings Co., Inc.
DALLAS, TEXAS
Tri-State Machinery Co.
DENVER, COLORADO
The Mine & Smelter Supply Co.
HOUSTON 2, TEXAS
The H. L. Thompson Co.
KANSAS CITY, MISSOURI
Blackman & Nuetzel Mach. Co.
LOS ANGELES 11, CALIF.
Machinery Sales Co.
NEW ORLEANS, LOUISIANA
Frederic & Baker
OMAHA 2, NEBRASKA
Fuchs Machinery & Supply Co.
PORTLAND, OREGON
Hallidie Machinery Co., Inc.
RICHMOND 2, VIRGINIA
Smith-Courtney Company
SAINT LOUIS 8, MISSOURI
Blackman & Nuetzel Mach. Co.
SALT LAKE CITY, UTAH
The Mine & Smelter Supply Co.
SAN FRANCISCO 3, CALIF.
B-H-S Machinery Sales Co.
SEATTLE 4, WASHINGTON
Hallidie Machinery Co., Inc.
SHREVEPORT, LOUISIANA
Frederic & Baker
TULSA, OKLAHOMA
Blackman & Nuetzel Mach. Co.
WASHINGTON, D. C.
The J. H. Elliott Co.

CANADIAN REPRESENTATIVE
TORONTO, ONTARIO
F. F. Barber Machinery Div.
Massey-Harris-Ferguson, Ltd.

EXPORT DEPARTMENT
MOUNT GILEAD, OHIO
The Hydraulic Press Mfg. Co.
CABLE ADDRESS: "HYDRAULIC"

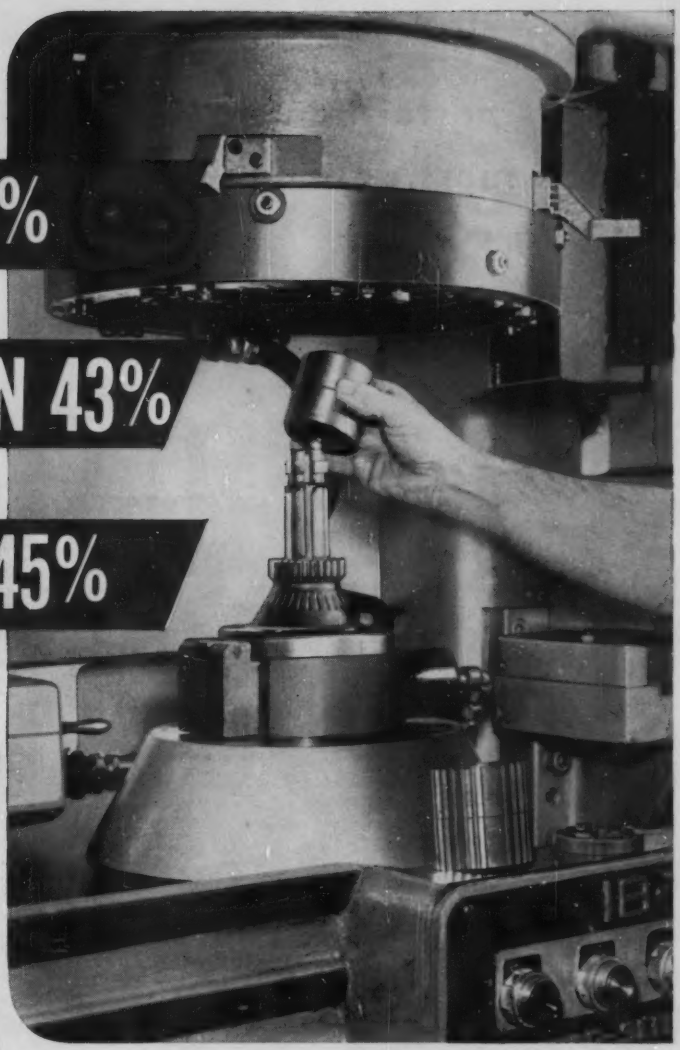
HPM

THE HYDRAULIC PRESS MFG. CO. / MOUNT GILEAD, OHIO, U. S. A.

TOOL LIFE UP 75%

DOWN-TIME DOWN 43%

PRODUCTION UP 45%



USING SHEAR-SPEED SOLUBLE OIL

on multiple "single-point" form cutting operation in the plant of a large auto manufacturer. IMPARTIAL PRODUCTION TESTS of previous "best" cutting fluid vs. SHEAR-SPEED Soluble Oil were run under *exactly* similar conditions—same machine, same parts, same tool grinding, same coolant flow.

JOB SPECS: 24-tooth transmission gears, 2.5″ pitch dia., 1.185″ face width, cut two at a time on gear shaper from SAE bar steel, 207-228 BHN.

ACTUAL TEST DATA (averaged)

■ Previous Best Cutting Fluid

■ SHEAR-SPEED Soluble Oil

OVERALL TOOL LIFE	15,200 parts / 26,600 parts	75% improvement
DOWN-TIME PER PART	.0625 min. / .0357 min.	43% improvement
PARTS PER HR. (INC. DOWN-TIME, ETC.)	86 / 125	45% improvement
CYCLE TIME* (FLOOR-TO-FLOOR)	55 sec. / 35 sec.	36% improvement

*Tool life increased despite higher cutting speed.

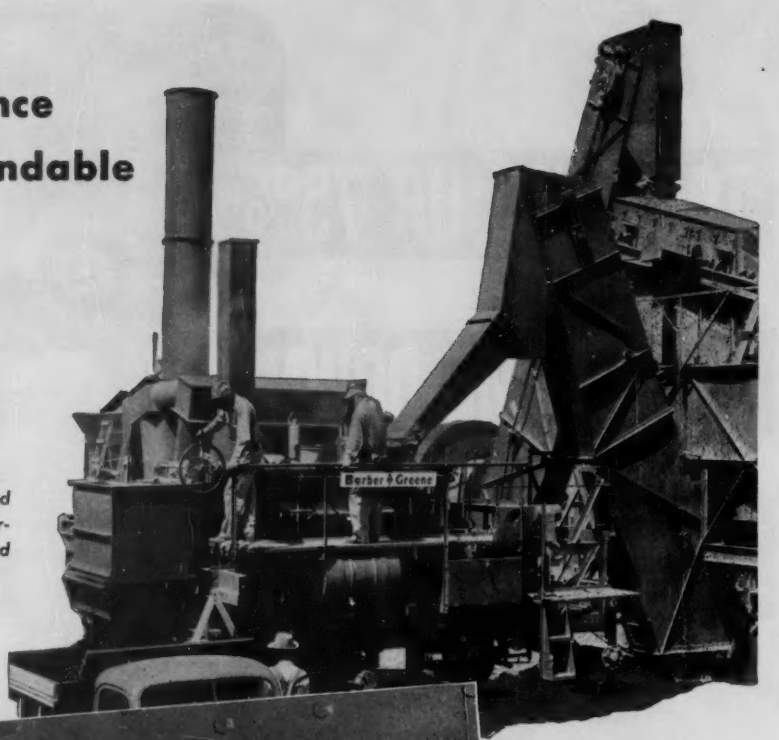
A few select sales areas still available.

Convince yourself of the amazing advantages and versatility of SHEAR-SPEED Soluble Oil in your own plant. Sold only on a satisfaction guaranteed test basis. Write for Bulletin SO-53 and price list.

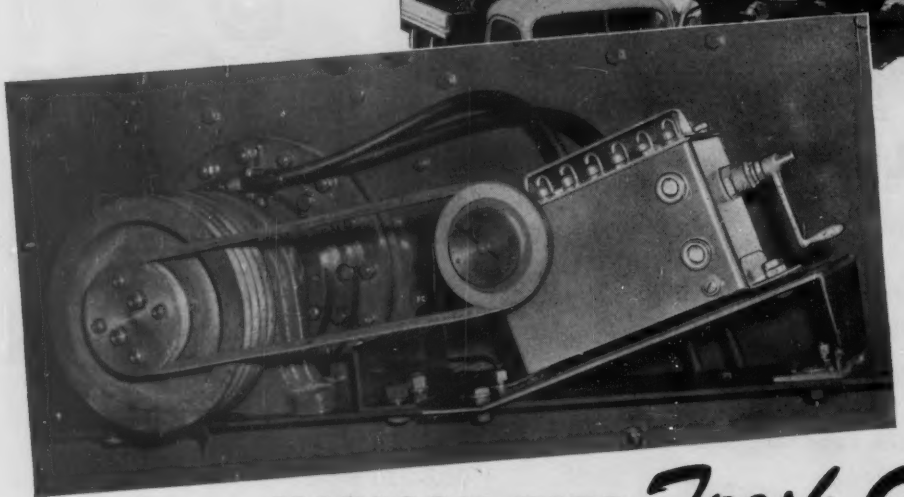
SHEAR-SPEED CHEMICAL PRODUCTS

7125 E. McNICHOLS RD. *A Division of Michigan Tool Co.* DETROIT 12, MICH.

machines of great performance use the most dependable oiling system ever developed



A Model 50 Madison-Kipp Lubricator installed as original equipment on a Model 848 Barber-Greene Asphalt Mixing Plant manufactured by Barber-Greene Co., Aurora, Illinois.



MADISON-KIPP *Fresh Oil*

. . . by the measured drop, from a Madison-Kipp Lubricator is the most dependable method of lubrication ever developed. It is applied as original equipment on America's finest machine tools, work engines and compressors. You will definitely increase your production potential for years to come by specifying Madison-Kipp on all new machines you buy where oil under pressure fed drop by drop can be installed.

There are 6 models to meet almost every installation requirement.

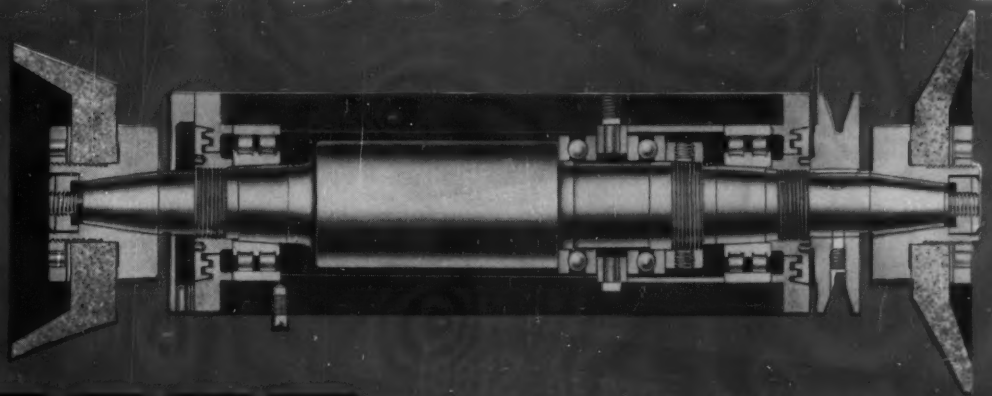
kipp

MADISON-KIPP CORPORATION
203 WAUBESA STREET • MADISON 10, WIS., U. S. A.

• Skilled in Die Casting Mechanics • Experienced in Lubrication Engineering • Originators of Really High Speed Air Tools

For more information on products advertised, use Inquiry Card, page 243

AFTER
8,760,000,000
REVOLUTIONS



POPE PRECISION SPINDLES

with double row cylindrical roller bearings and ball thrust bearings will still be taking the lead — still be producing superior finishes — still be *Precision* Spindles.

That is why you can *Specify* POPE Spindles with confidence

Send us your specifications and let our engineers recommend the one best Spindle for the job you are going to do.

No. 100

Specify **POPE** PRECISION SPINDLES

POPE MACHINERY CORPORATION
Established 1920
261 RIVER STREET • HAVERHILL, MASSACHUSETTS

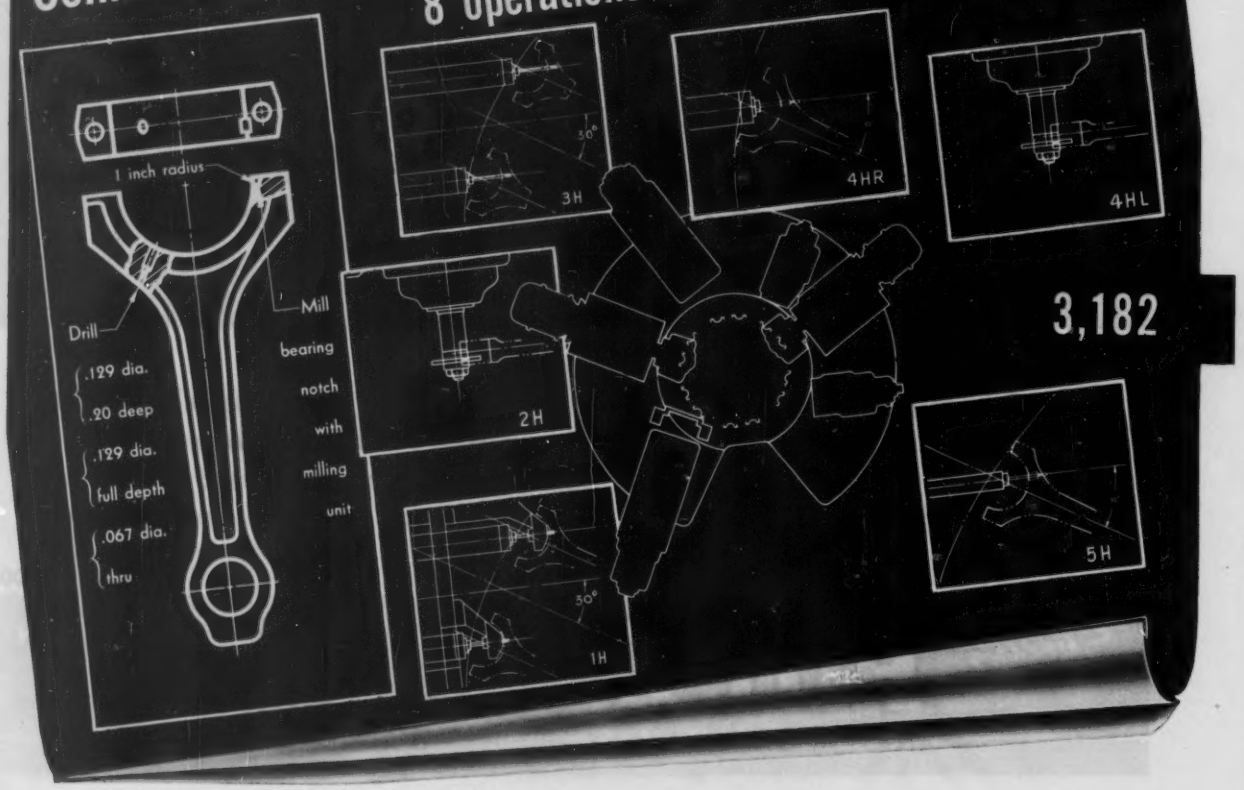
For more information on products advertised, use Inquiry Card, page 243

"Operations Kingsbury" . . . required accuracy, low cost, high



Connecting Rod Forged Steel 8/10¢ each

8 operations on 2 parts in one cycle



production for interchangeability

Here are two Kingsburys, custom-built to serve in widely separated product fields. Each justifies its investment. One drills a small hole and mills a notch in a forged steel connecting rod. The other works on a cast aluminum sole plate for a steam iron: drills 26 holes and spot-faces a boss.

Could this work be done on single-operation machines? "Yes." But could the connecting rods be machined for eight-tenths of a cent each? And the sole plates for one-and-one-fifth cents each?

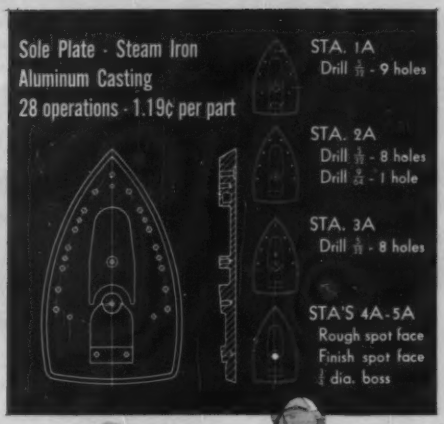
Kingsburys have so many advantages. For example: One work fixture positions the part for each successive operation. Standard units perform the operations within a pre-determined time cycle to obtain the best output with required accuracy. Tolerances are held to specifications. Scrap loss is reduced to a minimum. Floor space is saved. Handling is reduced. One operator loads and unloads the machine. And your parts will be interchangeable, reducing your assembly time.

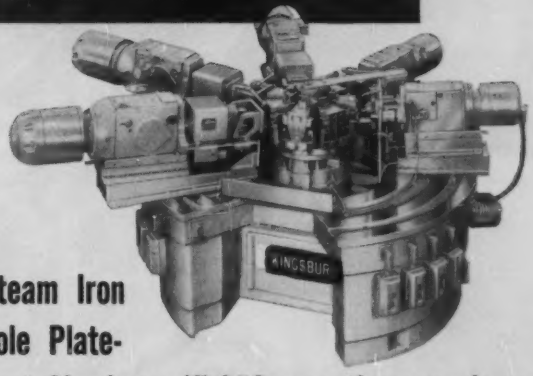
You can drill, spot drill, flat-bottom, ream, burr-ream, counterbore, countersink, mill, end-mill, hollow-mill, tap, thread, face, spot-face, form, recess, saw, trepan . . . all within certain limitations. For instance: Your product must be such that it can be machined within the limits of 5 HP units, and of a size and/or weight that can be handled efficiently by an operator.

We have some interesting bulletins we shall be glad to send you. Perhaps you manufacture a part where a few cents saved would put you in a better profit position and pay for the cost of a Kingsbury. Let's talk it over.

Kingsbury Machine Tool Corp.
107 Laurel Street, Keene, N. H.

KINGSBURY
AUTOMATIC DRILLING AND TAPPING MACHINES
for Low-Cost High Production





Steam Iron Sole Plate- Cast Aluminum 17,920 operations per hour

Here's a case where a Kingsbury really "gangs up" to get the work out! The part is a cast aluminum sole plate for a steam iron; 26 angular holes to be drilled and one boss to be spot-faced.

The machine has an 80-inch base and a 20½-inch diameter index table with 7 fixtures. Five drilling units are mounted on the base. Two of these have 9 spindles each, one has 8 spindles and two have single spindle heads to perform the rough and finish spot-facing operations on one ¾-inch boss. Bushings guide all tools.

The table indexes through five working stations. At Station 6, work is unclamped automatically and removed by the operator. At Station 7, the operator places new work in the fixture, where it is clamped automatically.

Operations per hour on two forged steel connecting rods

The problems: to drill a concentric step-down hole thru, at an angle of 30°, in each of two connecting rods; also to mill a notch in each rod for the bearing.

To obtain high production at low cost per part, the machine was designed to handle *two* parts in each work-holding fixture. Six Horizontal (H) Units are mounted radially on an 80-inch base. The 26-inch index table has six of these "twin" work-holding fixtures, automatically clamped and unclamped. The machine indexes through five work stations where eight operations are performed. The longer holes are drilled in two operations to maintain a balanced time cycle at each station. Bushings guide all drills.

Station 1, Unit 1 H has two-spindle head and drills one .129 dia. hole at an angle of 30° in each rod to half the required depth.

Station 2, Unit 2 H with milling unit mills the notch in the *right* hand part.

Station 3, Unit 3 H has two-spindle head and completes the drilling of the .129 hole in each rod.

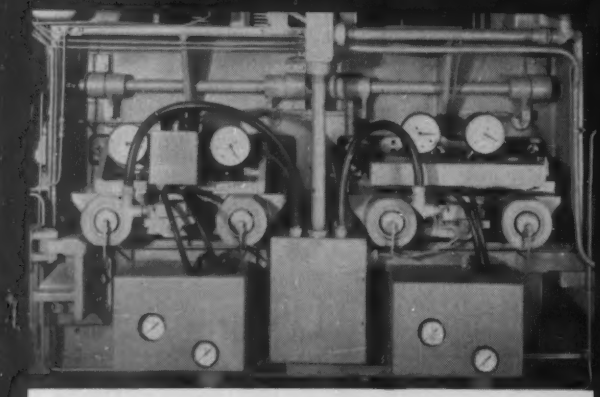
Station 4, Unit 4 HR is a single spindle unit with sensitive feed; drills .067 hole thru from bottom of .129 hole in *right* hand part. *Unit 4 HL* with milling unit mills the notch in the *left* hand part.

Station 5, Unit 5 H is a duplicate of Unit 4 HR: drills .067 hole thru from bottom of .129 hole in *left* hand part.

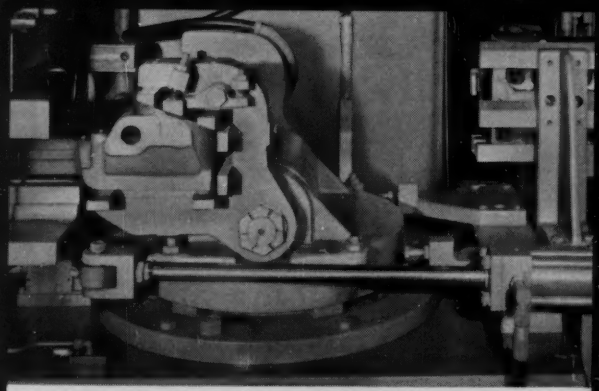
Station 6: operator removes the two finished parts and replaces them with two new parts. Parts are unclamped and clamped automatically in the work fixture.

NEW NATCO HOLEWAY *machines...*





AIR INSPECTION Stations No. 9, 29 and 30 of the first machine check reamed holes for diameter and location.



90° ROTATE and TURN Station No. 32 of the first machine rotates part 90° around each of two axes simultaneously for proper positioning in second machine.

ALL OPERATIONS COMPLETELY AUTOMATIC!

MACHINE No. 1 (35 Station)

1 Loading	1 90° Rotating
14 Working	2 Interference Relief
4 Checking	10 Idle
2 Chip Dumping	1 Unloading

MACHINE No. 2 (25 Station)

1 Loading	1 90° Rotating
13 Working	3 Idle
3 Checking	1 Ejecting and Replacing
1 Air Testing	1 Unloading

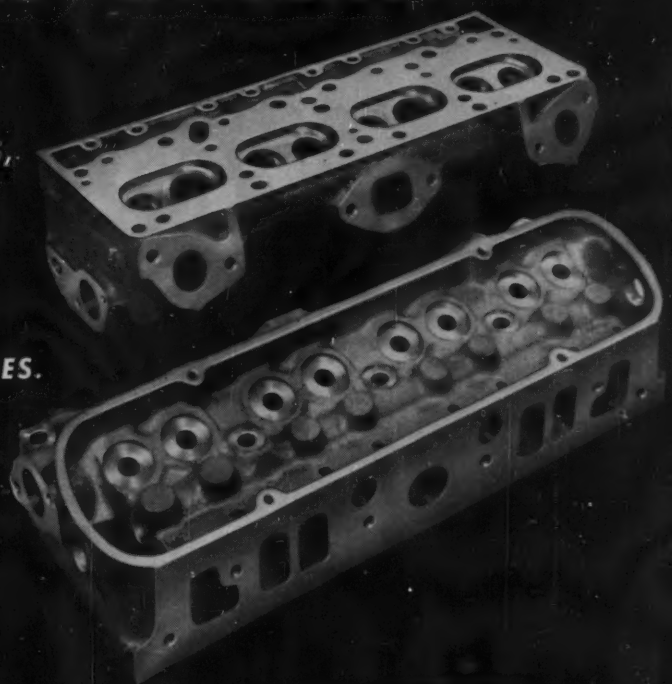
. . . ANOTHER MACHINE

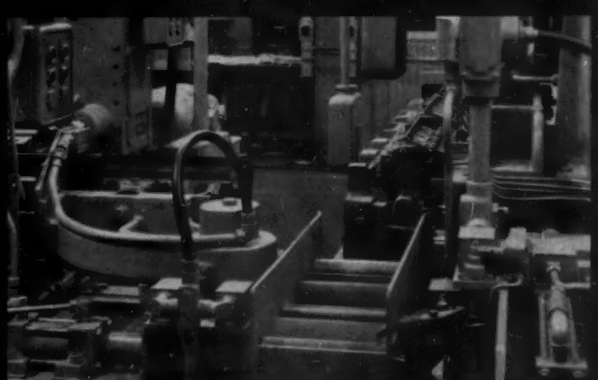
NATCO ENGINEERED for quality and quantity production

106 CYLINDER HEADS

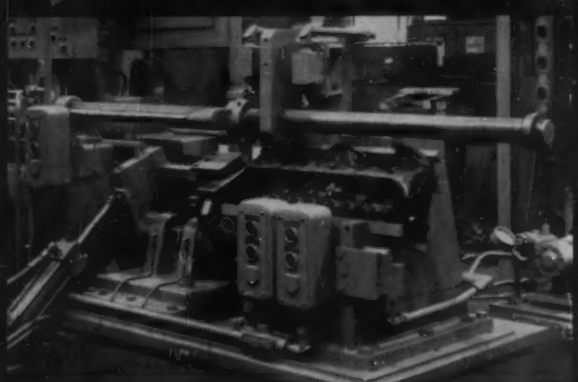
PER HOUR AT 85% EFFICIENCY!

DRILLS, REAMS, MILLS,
CORE DRILLS, COUNTERBORES,
SPOT FACES and CHAMFERS
ALL SIX SIDES.
REMOVES CHIPS,
INSPECTS HOLE DEPTHS,
SIZES and CENTER DISTANCES.
CHECKS OIL GALLERY
HOLE and EJECTS
DEFECTIVE PART and
REPLACES WITH
SALVAGED PART.





REJECTION and REPLACEMENT Station 17 of second machine air checks oil gallery hole, automatically ejects defective part, station 18 automatically replaces with salvaged part.



70° ROTATION Station No. 24 of the second machine rotates part 70° to bring valve hole in horizontal plane.



Call a Natco Field Engineer

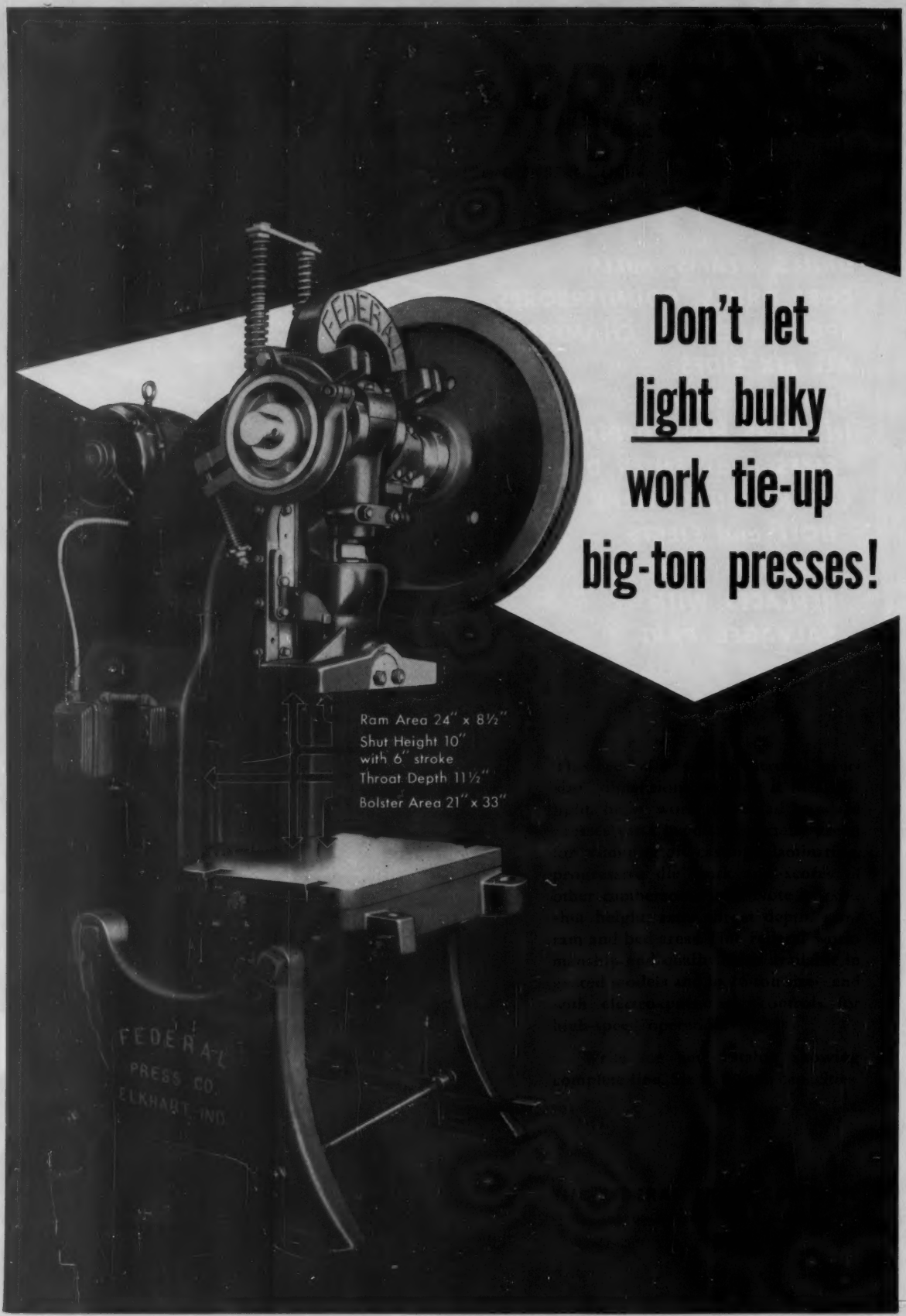
to help you solve your problems in
Drilling, Boring, Facing and Tapping

NATCO

NATIONAL AUTOMATIC TOOL COMPANY, INC., Richmond, Indiana

Branch Offices

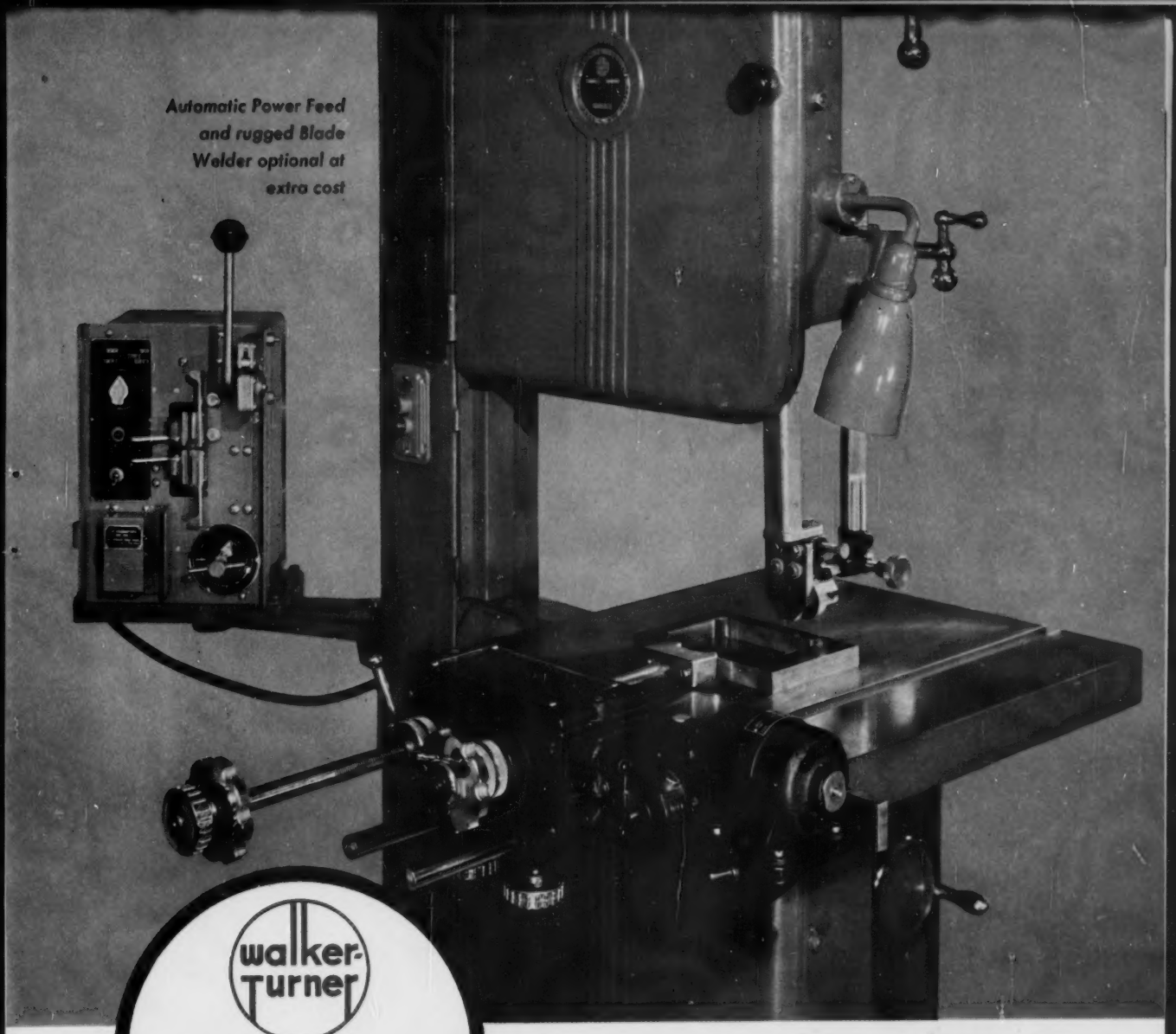
CHICAGO, 2009 Engineering Bldg. • DETROIT, 10138 W. McNichols Rd.
BUFFALO, 1807 Elmwood Ave. • NEW YORK, 35 Beechwood Ave., Mount Vernon



Don't let light bulky work tie-up big-ton presses!

For more information on products advertised, use Inquiry Card, page 243

Automatic Power Feed and rugged Blade Welder optional at extra cost

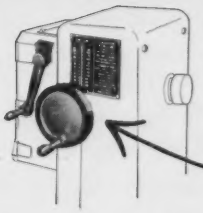


walker-turner

Variable Speed Drive

cuts anything that can be cut

50 TO 4500 SURFACE FEET PER MINUTE



A turn of the handwheel—while the machine is running—sets blade speeds ***in stepless variation from 50 to 450 SFM in low range, or 500 to 4500 SFM in high range.*** Indicator registers exact speed.

The Walker-Turner 16" Variable Speed Band Saw cuts as you want it to cut. Always on the job, this LIGHT-HEAVYWEIGHT is easily set at exactly the right speed for any stock you work: tough steel... non-ferrous metals... plastics... wood. No time lost in belt changes, no efficiency lost because of inadequate speed range. See this versatile precision tool with *Variable Speed Drive* at your Walker-Turner distributor now.

There is much more to this Walker-Turner LIGHT-HEAVYWEIGHT story that our factory-trained distributor in your area would like to tell you. You will find him an expert on industrial equipment, a good man to know. And he's as near as your phone. So why not call him, or write us for his name and more information—today!



WALKER-TURNER

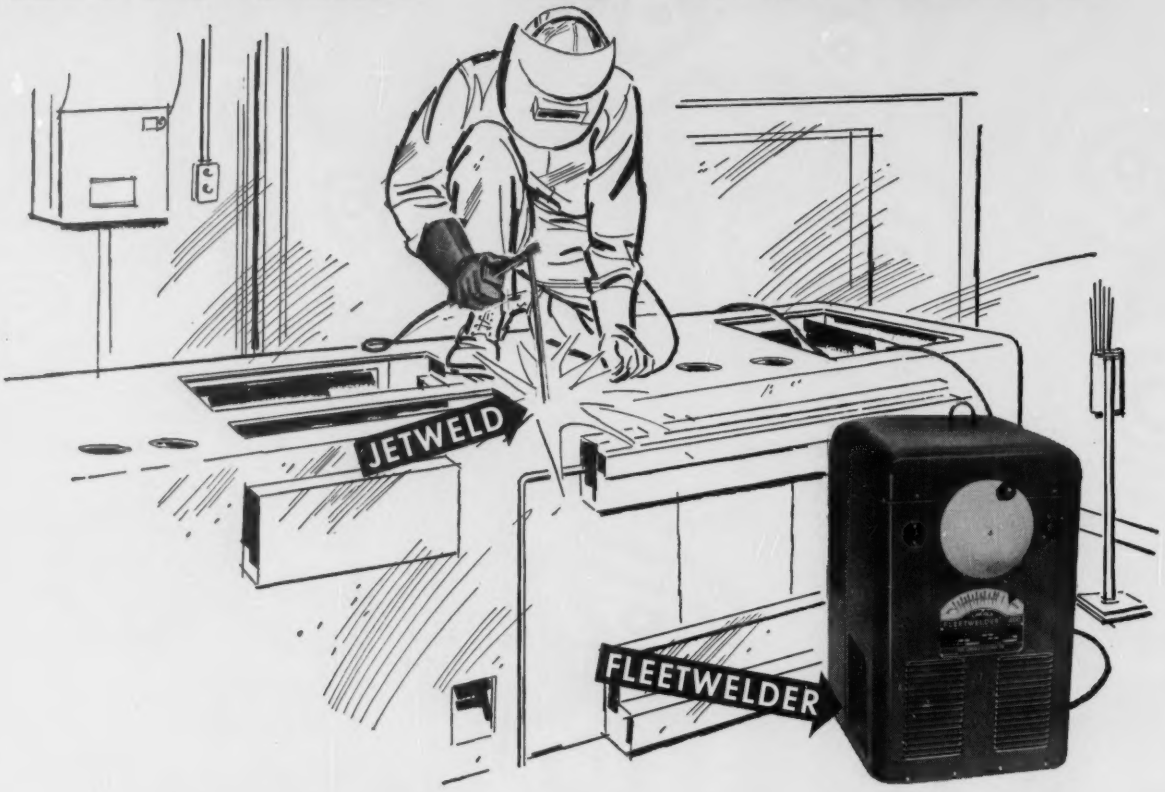
• DIVISION •

KEARNEY AND TRECKER CORPORATION

PLAINFIELD, N. J.

DRILL PRESSES — Hand and Power Feed • RADIAL DRILLS
Wood and Metal Cutting BAND SAWS • TILTING ARBOR SAWS
RADIAL SAWS • JIG SAWS • LATHES • SPINDLE SHAPERS • JOINTERS
BELT AND DISC SURFACERS • FLEXIBLE SHAFT MACHINES

LINCOLN "JETWELDING"



...industry's greatest team for low cost, high speed hand welding

Lowest manual welding costs are achieved with "Jetweld", the high speed welding electrode developed and introduced by Lincoln, and "Fleetwelder"—Lincoln's AC transformer-type welder.

For the first time, "Jetweld" utilizes powdered metal in the electrode coating... enabling use of higher currents to speed welding. Iron powder becomes an additional source of metal for the weld. Welds are more uniform, free of undercut, of X-ray quality.

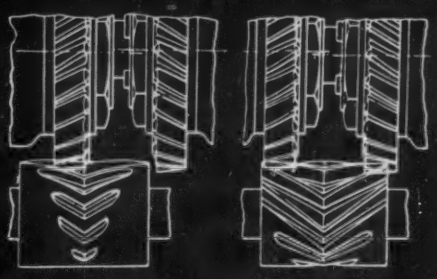
THE RESULT: Average increases in speed of 35%... *and more.*

CHECK LINCOLN'S NEW LOW PRICES
Lincoln's new combination of lower AC machine prices and faster welding with "Jetweld" can cut your welding costs. See for yourself. Have your Lincoln representative check your requirements for electrodes and welders. Call or write.

THE LINCOLN ELECTRIC COMPANY
Dept. 1205
CLEVELAND 17, OHIO
THE WORLD'S LARGEST MANUFACTURER OF ARC WELDING EQUIPMENT

For more information on products advertised, use Inquiry Card, page 243

TAKE A LOOK AT FARREL-SYKES ACCURACY

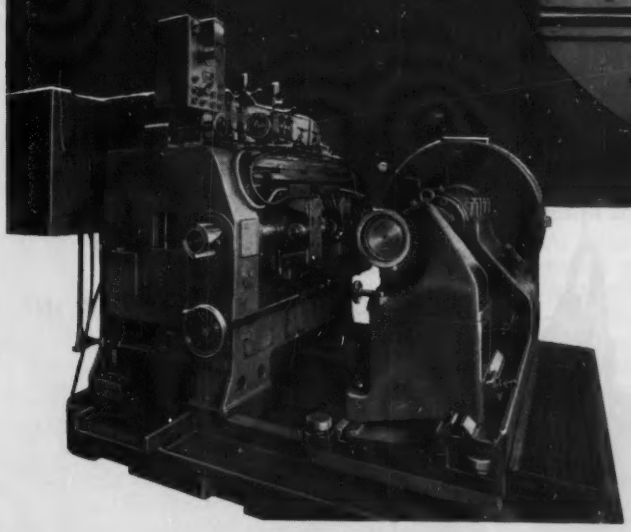


PRECISION GENERATION

The cutters of Farrel-Sykes machines reciprocate, one cutting when movement is in one direction and the other when the movement is reversed. Each ends its stroke at the center of the blank. As they cut, they rotate to generate the helices and also slowly revolve in unison with the gear blank to generate the tooth contours precisely.



Start of cutting operation on a continuous tooth herringbone pinion with integral shaft.



FARREL-BIRMINGHAM COMPANY, INC., ANSONIA, CONN.

Plants: Ansonia and Derby, Conn., Buffalo, N. Y.
Sales Offices: Ansonia, Buffalo, New York, Cambridge (Mass.), Akron, Cleveland, Chicago, Los Angeles, Houston

Farrel-Birmingham®

The accuracy inherent in the operating principle of the Farrel-Sykes gear machine—*precision generation*—gives gears precise tooth spacing, profile and helix angle.

Besides precision, the "twin-head" generator gives you versatility, high production and convenient operation. It makes fast, simple work of cutting every type of herringbone gear, single helical and spur gears, two members of a cluster gear simultaneously, and other toothed and cylindrical forms.

Write now for details of this accurate and versatile gear generator.

FB-950

For more information on products advertised, use Inquiry Card, page 243

YOU GET *SPEED*

PLUS ACCURACY

WITH MOORE JIG GRINDERS



HOLES from 1/64" to 8" Relocated and Ground within .0001" in One-Third Previous Time

Before hardening, this two-station die block was Moore-Jig-Bored to eliminate the need for excessive grinding. After hardening and surface grinding, all holes were Moore-Jig-Ground to exact size and location. Blank hole and center piercing hole were ground with ½° included taper. Little clearance could be allowed between punch and die. Jig grinding time: *only 2¾ hours.*



CONTOURS, Too, Accurately Jig Ground and Checked in One Setting

This flanged punch, impractical to grind by any other method, was a natural for the No. 2 Moore Jig Grinder. All radii—male and female—were ground accurately to location and size. The piece, having been set up on a rotary table, was aligned to permit grinding of the angular surfaces. And the entire contour was inspected by the "indicator measuring" method while the punch was still on the machine.

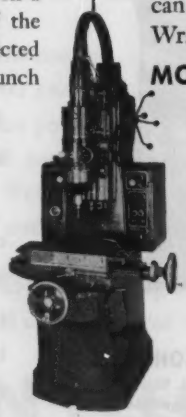
The word "versatile" must have been coined for the No. 2 Moore Jig Grinder. Not only does this machine relocate and grind straight and tapered holes with ease, but it contour grinds, chop grinds and slot grinds just as skillfully.

The Moore Jig Grinder, together with its toolroom teammate, the Moore Jig Borer, enables tool and die sections to be produced concurrently, puts diemaking on an interchangeable-parts-and-assembly basis. And it's also a time-saver on production jobs.

Employing the accurate lead screw measuring principle and a convenient system of coordinate hole location, the fast and sure Moore Jig Grinder eliminates hours of checking on bench and surface plate.

Why not find out how this remarkable machine can save *you* sizeable chunks of time and money. Write today for our detailed bulletin.

MOORE SPECIAL TOOL COMPANY, INC.
734 Union Ave., Bridgeport 7, Conn.



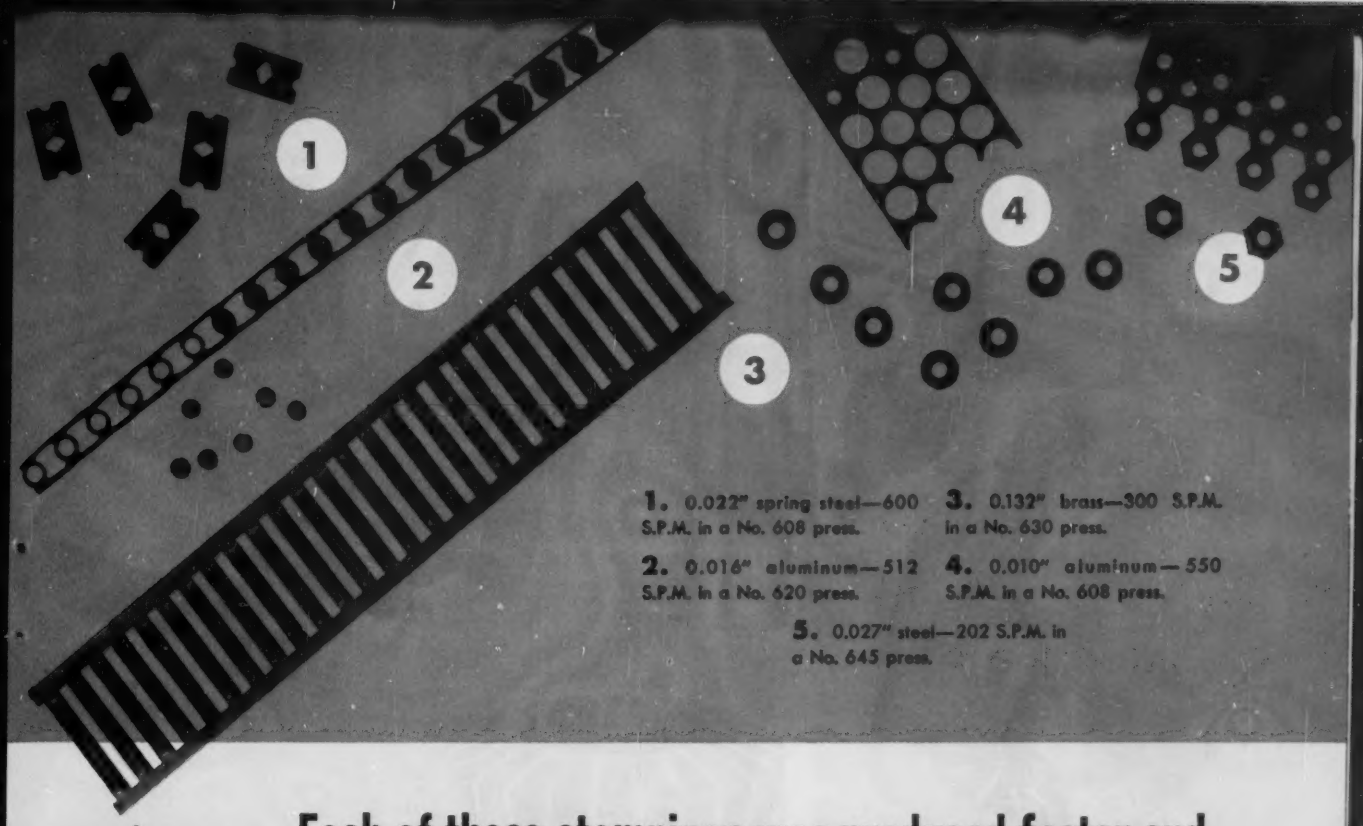
NO. 2 MOORE JIG GRINDER
Range 10" x 16" x 16" height. Grinding speeds from 12,000 to 60,000 rpm. Infinite feeds up and down; spindle-housing heat control. Features slot grinding attachment.

ADD MOORE TOOLS TO YOUR TOOLROOM

JIG BORERS • JIG GRINDERS • PANTO-CRUSH WHEEL DRESSERS • DIE FLIPPERS • MOTORIZED CENTERS • HOLE LOCATION ACCESSORIES

see our catalog in MACHINE TOOL CATALOGS or write for copy

For more information on products advertised, use Inquiry Card, page 243



1. 0.022" spring steel—600 S.P.M. in a No. 608 press.

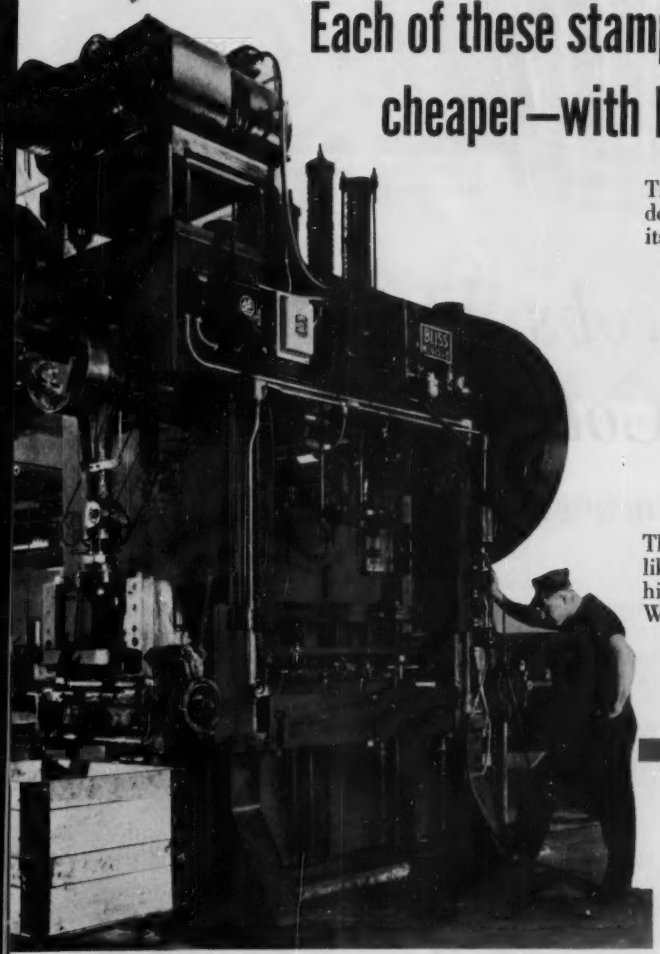
2. 0.016" aluminum—512 S.P.M. in a No. 620 press.

3. 0.132" brass—300 S.P.M. in a No. 630 press.

4. 0.010" aluminum—550 S.P.M. in a No. 608 press.

5. 0.027" steel—202 S.P.M. in a No. 645 press.

Each of these stampings was produced faster and cheaper—with BLISS High Production Presses



The Bliss 600 series of High Production Presses, especially designed and developed for high-speed stamping, has proved itself on America's faster production lines:

- At Lima Register—5 Bliss Automatic Presses replaced 65 hand-fed presses. Example of the unusual savings: floor register valve costs only 1/25th of a hand-fed stamping.
- At IBM—5 Bliss Automatic Presses are used for short run typewriter parts production—die changeover is so easy that production has been boosted "an estimated 25%".
- At Briggs & Stratton—350 magneto armature parts are turned out each minute—on one 620 Bliss High Production Press!

There's a Bliss bulletin which describes in detail examples like these—examples which may show how you can solve a high production problem of your own—with a Bliss press. Write for catalog 27-A today.

BLISS
SINCE 1857

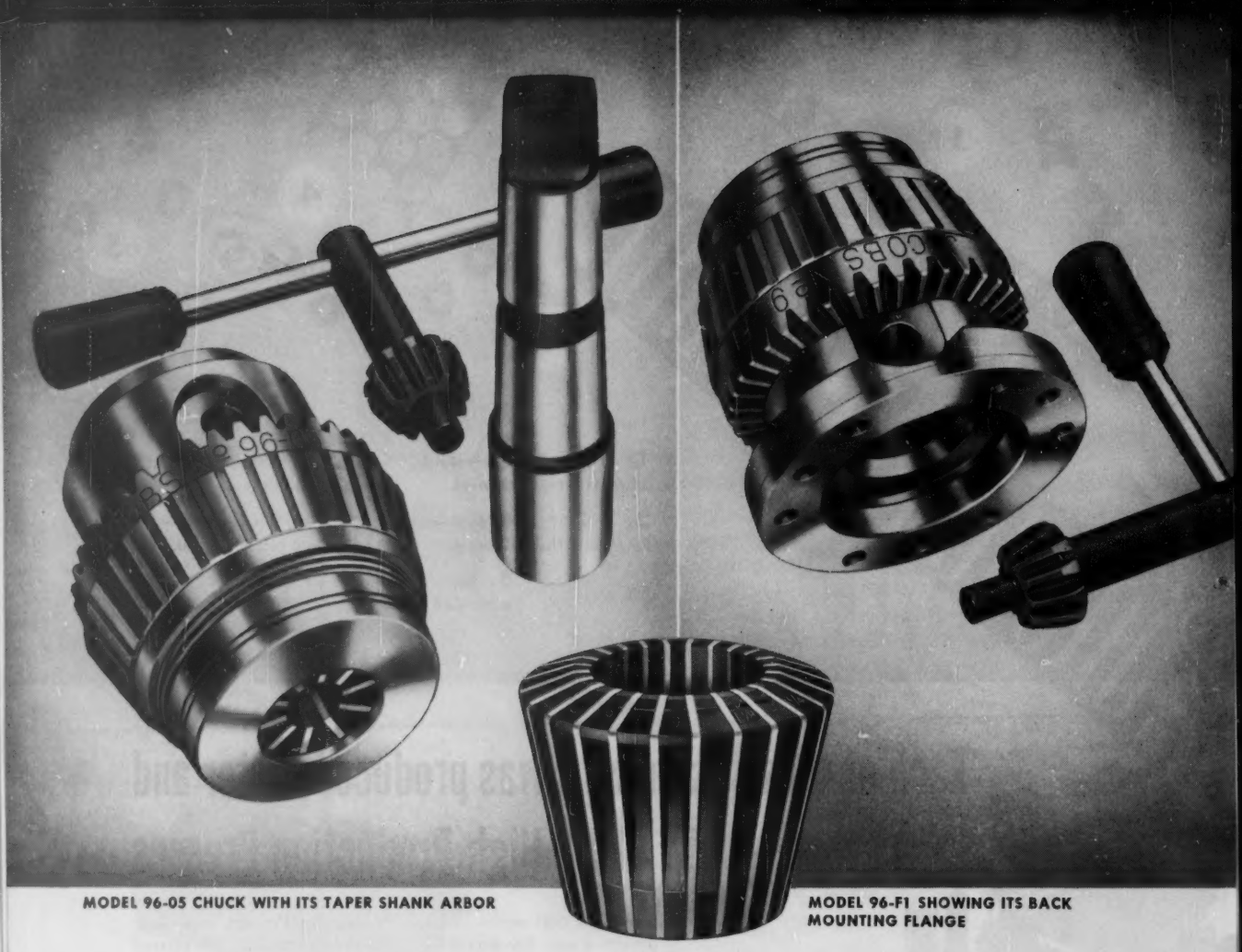
is more than a name...it's a guarantee!

E. W. BLISS COMPANY, Canton, Ohio

PRESSES, ROLLING MILLS, SPECIAL MACHINERY

Subsidiary: The Die Supply Company, Cleveland, O. • E. W. Bliss (England) Ltd., Derby • E. W. Bliss Company (Paris) France

U. S. Plants in Canton, Salem and Toledo, Ohio; Hastings, Michigan; and San Jose, Calif. *Branch Offices* in Chicago, Cleveland, Dayton, Detroit, Indianapolis, New Haven, New York, Philadelphia ,Rochester, Toledo; and Toronto, Canada. *Other representatives throughout the world.*



MODEL 96-05 CHUCK WITH ITS TAPER SHANK ARBOR

MODEL 96-F1 SHOWING ITS BACK MOUNTING FLANGE

NOW! New Jacobs Model 96 Rubber-Flex Collet Chuck

brings famous grip to whole new group of applications

Grinders! Milling machines! Jig borers! Jig grinders! Lathes! Various types of special machinery where precise compact collet closure is vital!

ALL get the benefit of the famous Jacobs Rubber-Flex Collet grip in the new Jacobs Model 96 Collet Chuck.

The long, steel jaws of this collet — locked together with oil-resistant synthetic rubber — provide an absolutely parallel grip over the entire bearing surface.

What's more, each collet has a full $\frac{1}{8}$" range so that the standard set of eleven Rubber-Flex Collets cover the gripping range of eighty-eight split steel collets! A geared key tightening device and self-tightening toggle action of the collet jaws give the chuck gripping power far beyond that obtained with split steel collets. Chucks any diameter bar between $\frac{1}{16}$" and $1\frac{3}{8}$".

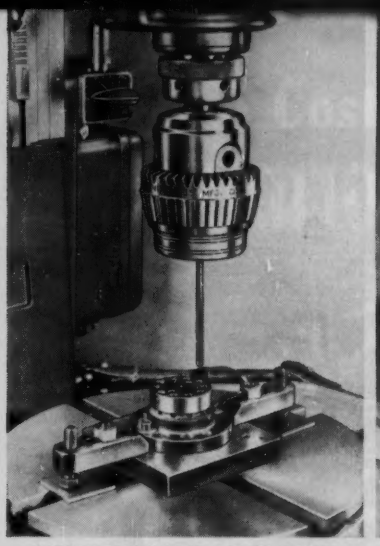
For work holding: Model 96 Collet Chuck permits precision chucking of bright finished bars, with close or wide tolerance diameters, resilient or compressible materials, tubing and brittle materials such as ceramics or glass.

For tool holding: Model 96 Collet Chuck can be used for drilling and reaming on jig borers and other high precision machines, holding proving bars and indicators. Extreme accuracy and wide capacity range make it ideal for tool and cutter grinding on cylindrical and cutter grinders.

TWO MODELS: Model 96-05, $135.00; Model 96-F1, $150.00. Rubber-Flex Collets, $12.00 each.

For further details, ask your Industrial Supply Distributor for Catalog 54-CC. The Jacobs Manufacturing Company, West Hartford 10, Conn.

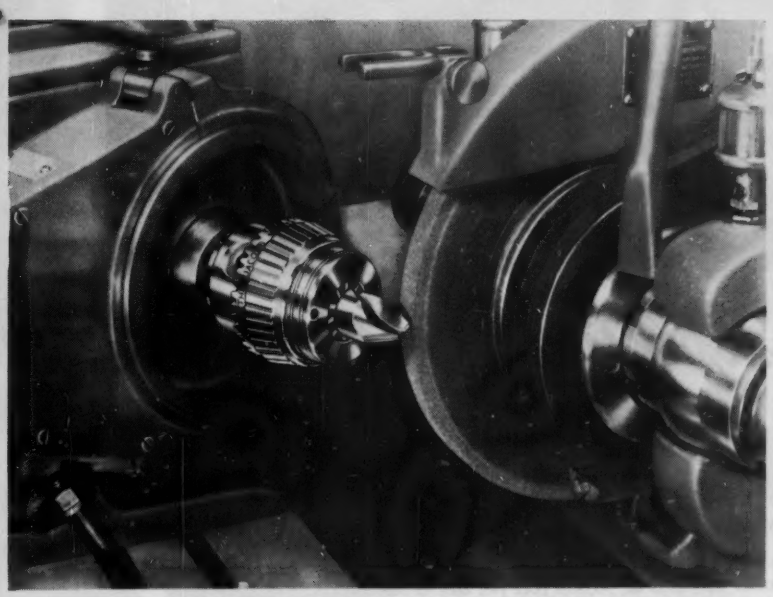
Jacobs
RUBBER-FLEX COLLETS



PRECISION REAMING ON JIG BORER with Model 96-05.



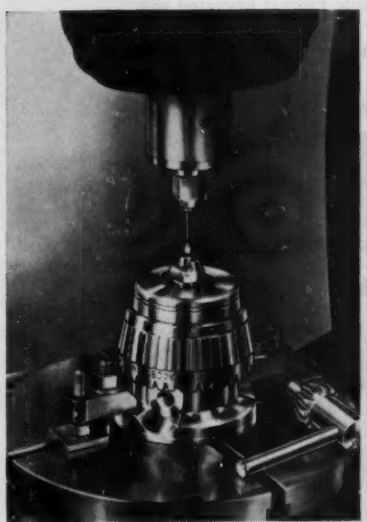
NEW JACOBS MODEL 96-F1 COLLET CHUCK on magnetic chuck holds work for surface grinder.



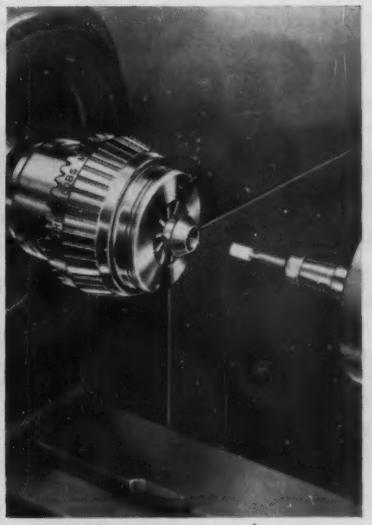
MODEL 96-05 ADAPTED TO HEADSTOCK OF CYLINDRICAL GRINDER.



CHUCKING WORK ON VERTICAL MILLING MACHINE with Model 96-F1.



NEW CHUCK Model 96-F1 here holds work on jig grinder.



PRECISION BUSHING GRINDING with Model 96-05.

IF IT'S A

JACOBS

IT HOLDS

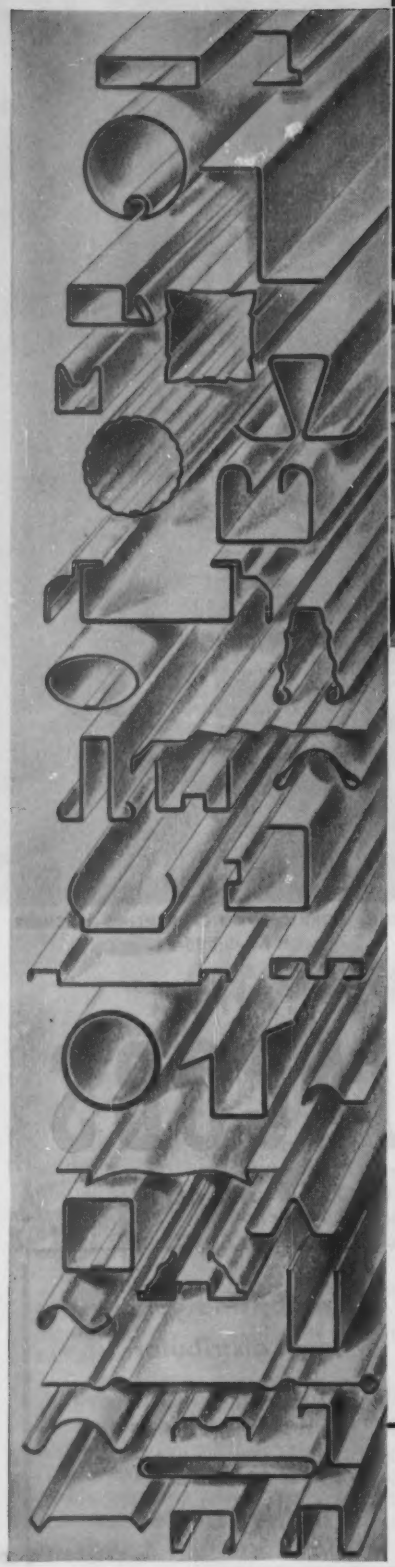
Jacobs and your local distributor

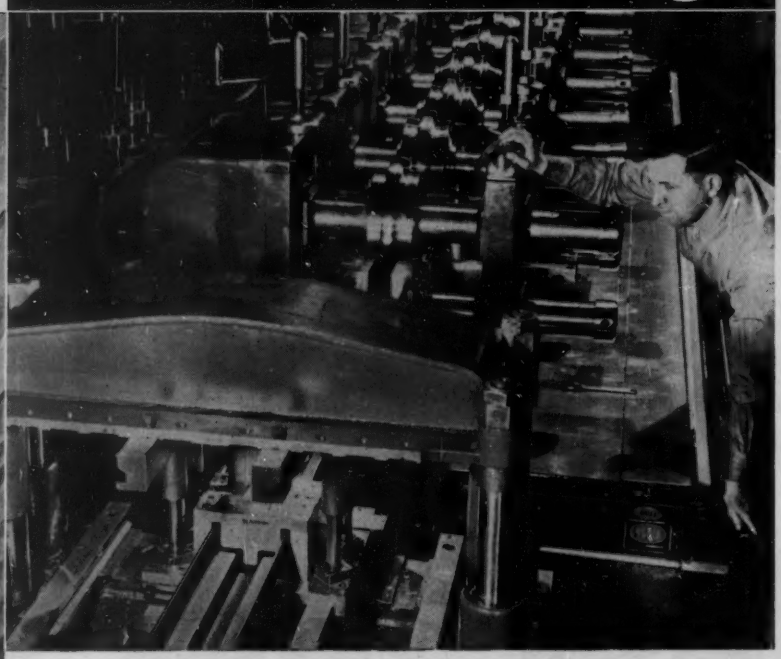
are ready to deliver the chucks you need and the service you deserve.

. . . first in chucks

. . . first in service

Cold-Roll-Forming





simplest, fastest, most economical—

In the assembly of your products, to the wide extent that cold-roll-formed components can be used, substantial economies can be effected.

A Yoder Cold-Roll-Forming Machine with one operator and a helper will make upwards of 30,000 feet per day. Thus the cost usually is only a small fraction of a cent per foot for converting strip into structural shapes, trim, mouldings, panels, tubular or box shapes.

The machine may, therefore, be highly profitable even if operated only a few days per month. After you install it for a given purpose, you are likely to discover other things which can be done better and more cheaply on it than by methods heretofore employed.

You may also find it practical to combine other operations with cold-forming, such as curving, coiling, embossing, welding, perforating, notching, etc., at little or no extra labor cost. Yoder engineers are always glad to assist in making up such multi-function production lines.

The Yoder Book on Cold Roll Forming is a valuable source of information on the scope, mechanics and economics of the art. Send for free copy.

THE YODER COMPANY • 5504 Walworth Ave., Cleveland 2, Ohio

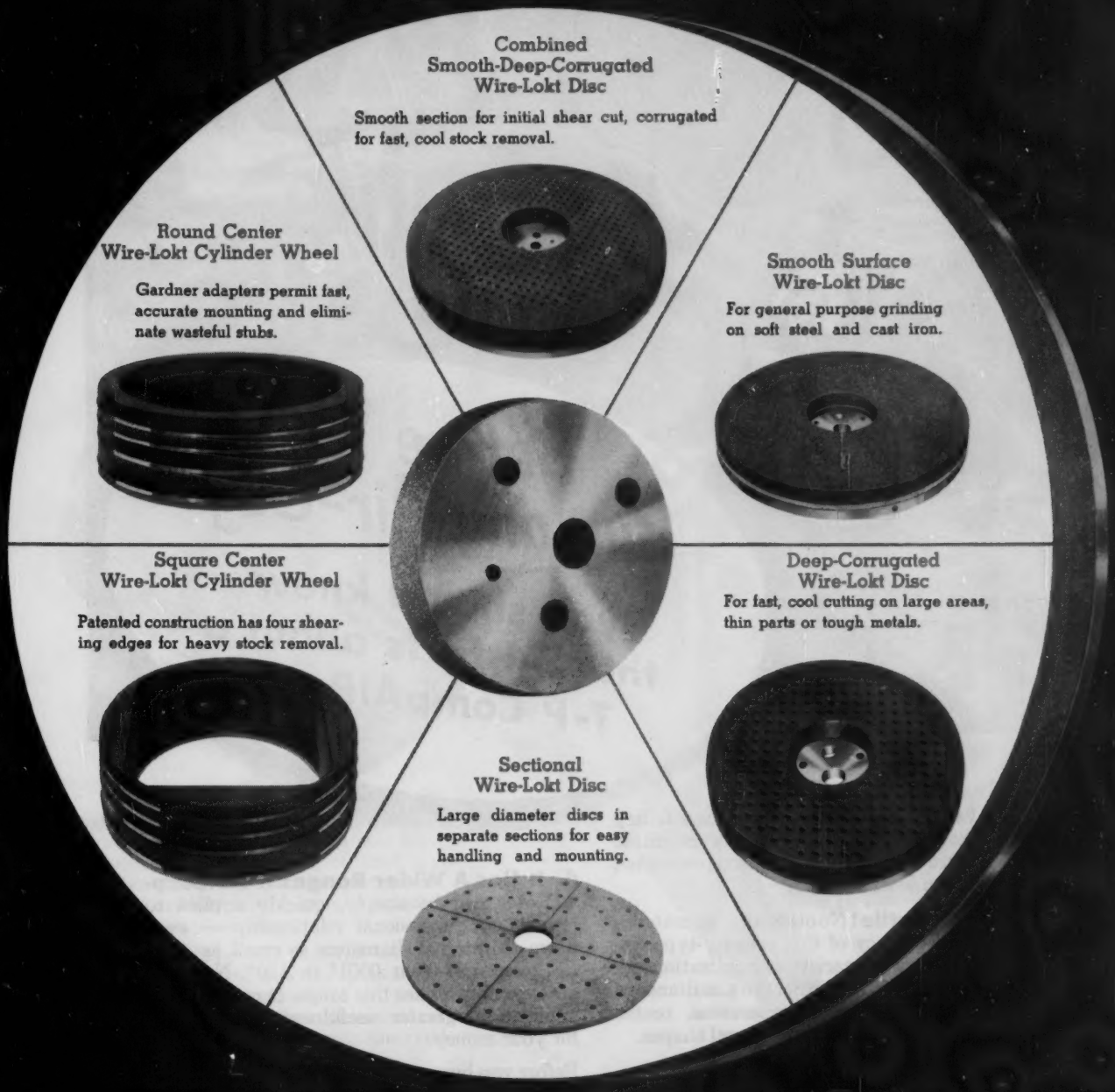
Complete Production Lines

★ COLD-ROLL-FORMING and auxiliary machinery
★ GANG SLITTING LINES for Coils and Sheets
★ PIPE and TUBE MILLS—cold forming and welding

ENGINEERING YODER MANUFACTURING

For more information on products advertised, use Inquiry Card, page 243

6 Cost Cutting Abrasive Ideas to Cut Your Grinding Costs



118A

- Wire-Lokt Safety Construction
- Tailored to Your Grinding Needs
- Bonds for Wet or Dry Grinding
- For All Standard Types of Mounting
- Nation-wide Abrasive Engineering Service

Your local Gardner Abrasive Man is ready to help you. Write and we will have him call at your plant.

GARDNER MACHINE COMPANY
414 Gardner Street · Beloit, Wisconsin

GARDNER
abrasive discs



Before You Buy any Air-Gage

you should know these 4 facts about a T-P CompAIRator

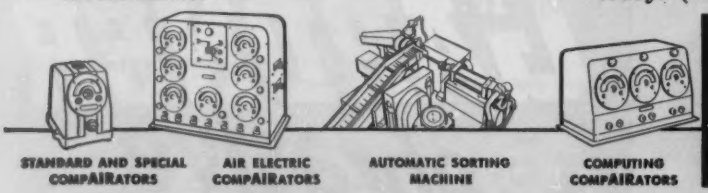
1. It's Faster! There's no flutter nor falling off of the pointer. No guesswork required. Readings are virtually instantaneous *even when long extension hoses are used.*

2. More Versatile! No other air gage matches the instant accuracy of this velocity-type circuit for such a wide variety of applications — from simple internal diameters to simultaneous checks of concentricities, squareness, center distance, etc. — bellmouth or barrel shapes.

3. It Costs Less to Operate! Vibration, hard knocks, jarring — even tilting — do not disturb the accuracy of a T-P CompAIRator. Its rugged construction eliminates expensive maintenance.

4. It Has A Wider Range! A T-P CompAIRator can be simply, quickly applied to check any dimensional relationship — even down to internal diameters as small as .055″ . . . tolerances from .0001″ to .120″. No other air gage approaches this range. It means wider application, greater usefulness, more gaging for your money.

Before you buy any air gage you'll want to talk over these advantages with a Taft-Peirce sales engineer. Discover the dollars and sense savings a T-P CompAIRator can make for you. Write today. (And ask for descriptive Handbook.)



STANDARD AND SPECIAL COMPAIRATORS | AIR ELECTRIC COMPAIRATORS | AUTOMATIC SORTING MACHINE | COMPUTING COMPAIRATORS

T-P means Top Precision

T P

THE TAFT-PEIRCE MANUFACTURING COMPANY, WOONSOCKET, RHODE ISLAND

For more information on products advertised, use Inquiry Card, page 243

Trust only Hydroforming *for this draw work!*

Vinyl-metal laminate is Hydroformed with *no change* to surface texture



Brightly-colored vinyl sheets, having a deep-grained, leather-like surface, are now being laminated to various gages of steel and aluminum sheets. The result is an attractive structural material having many interesting properties and possibilities.

But how to shape this material without marring or destroying the vinyl plastic presents a difficult forming problem . . . *except* for the Cincinnati Hydroform. Severe draws were accomplished *without altering* the vinyl surface.

The Hydroform's giant, *gentle* squeeze is achieving many production economies for numerous manufacturers. Let a Cincinnati Milling field engineer brief you on the advantages. For a description of Hydroform operation and specifications of the 8″, 12″, 19″, 23″, 26″ and 32″ machine sizes, write for Bulletin M-1759-3.

Vinyl-metal laminate drawn in one operation into a full hemisphere, 4½″ radius, and into a straight-walled cup, 4½″ dia. x 3½″ deep. Gage of the hemisphere is 0.049″ steel, 0.021″ plastic. Cup is 0.022″ steel, 0.015″ plastic.

CINCINNATI **Hydroform**

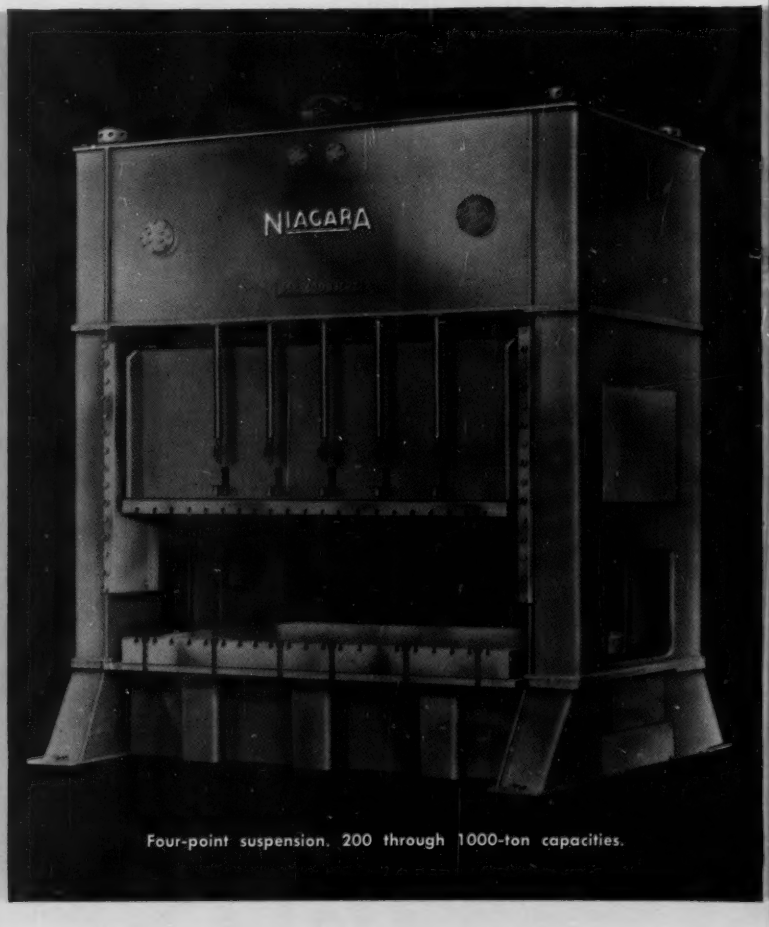
PROCESS MACHINERY DIVISION
THE CINCINNATI MILLING MACHINE CO.
CINCINNATI 9, OHIO, U.S.A.

NEW! MASTERFULLY ENGINEERED

excels in large, heavy tonnage



One-point suspension. 100 through 1000-ton capacities.



Four-point suspension. 200 through 1000-ton capacities.

ECCENTRIC DRIVE DELIVERS GREATER TORQUE WITH LESS DEFLECTION

In Niagara Series SE Presses, the eccentric is an integral part of the main gear (or gears) which rotates on a stationary pin rigidly supported in the crown, close to the point at which the pressure is exerted. Serving merely as a pivot, the pin carries no torsional load and relatively little bending load. Net result: Niagara's eccentric gear design can deliver greater torque with less deflection than other types of construction.

RUGGED, RIGID, ALL-STEEL FRAMES PROVIDE GREATER ACCURACY, LONGER DIE LIFE

Frames are rugged, all-steel, four-piece, tie-rod construction of great strength and rigidity, stress relieved in a furnace and thoroughly grit-blasted before machining. Each frame size has been scientifically tested for deflection to meet Niagara standards — the most exacting in the industry.

LOW INERTIA, PNEUMATIC FRICTION CLUTCH RUNS COOLER, WEARS LONGER

Most of the weight of the Niagara clutch continues to rotate with the flywheel. Only the drive shaft and driving plate start and stop with each cycle. The resulting low weight and inertia of the parts, picked up during clutch engagement, greatly reduce heat and wear. As the clutch rotates, it acts as a centrifugal blower, providing positive ventilation. Plates automatically compensate for normal wear, with no adjustment necessary.

MODERN, STREAMLINED DESIGN EMPHASIZES COMPACTNESS

The entire driving assembly is neatly housed in the crown. There is no exposed, overhanging flywheel, clutch, brake, shaft nor motor in the rear of the press to obstruct crane service, block light, throw grease or consume space unnecessarily.

LINE OF METALWORKING CHAMPIONS

drawing, punching and blanking work



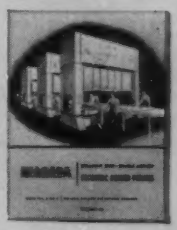
Two-point suspension. 200 through 1000-ton capacities.

Without equal in engineering design, performance and stamina, this great new line of Niagara Straight Side Eccentric Geared Presses is every inch a champion. It is an outstanding example of the advanced thinking that has made Niagara the pace-setter among builders of metal working machines for 75 years.

Masterfully engineered and ruggedly constructed to handle a tremendous variety of work, the new Niagara SE Series is the most practical and dependable press line built for:

- Work requiring large die areas.
- Heavy tonnage demands.
- Long stroke, deep drawing jobs where work is engaged high up on the stroke.
- Bottom-of-stroke blanking and punching.

THE COMPLETE STORY IS READY FOR YOU NOW!
Make a feature-by-feature appraisal of what these great new presses can do for you. Write for newly published, illustrated Bulletin 66. It will be forwarded promptly without obligation.



NIAGARA MACHINE & TOOL WORKS • BUFFALO, 11, N.Y.
DISTRICT OFFICES: DETROIT • CLEVELAND • NEW YORK • PHILADELPHIA
Dealers in principal U. S. cities and major foreign countries.

DELUXE OPERATING CONTROLS INSURE UTMOST SAFETY, EFFICIENCY AND CONVENIENCE

Compactly and conveniently arranged on a master panel, Niagara controls are instantly accessible for fingertip direction of every press operation: starting, slide adjusting, jogging, die tryouts, running and stopping. The latest safety devices provide maximum protection for die setter, operator and the press itself. Nothing has been overlooked. Trial runs assure that all controls are in proper working order before each Niagara press leaves the plant.

NIAGARA

STRAIGHT SIDE
ECCENTRIC GEARED
PRESSES

America's Most Complete Line of Presses, Shears, Machines and Tools for Plate and Sheet Metal Work

NIAGARA MACHINE & TOOL WORKS 1879 75 1954

What's the Best Fixed Gage For the Job?

Some tips from Taft-Peirce on the various types of fixed gages. Relative cost and wear resistance information will be furnished on request.

Plain Gages



T-P Cylindrical Plug Gages come in 5 progressively greater wear resistances: Standard Hardened Steel, Electrolized, Chromium Plated, Tantalum or Tungsten Carbide, Norbide. Pilots: Progressive, Emmerton Ball Bearing, Taft-Peirce.



T-P External Ring Gages also come in 5 progressively greater wear resistances: Standard Hardened Steel, Electrolized, Chromium Plated, Tantalum or Tungsten Carbide, Norbide, for exceptional resistance to wear.

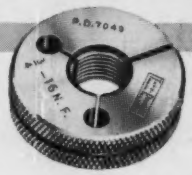


T-P Adjustable Snap Gages are available with gaging pins, round or square buttons, and regular or midget frames. Gaging members of high chrome alloy steel, Cemented Carbide or Norbide inserts.

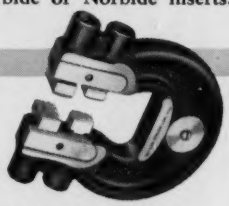
Thread Gages



T-P Limit Thread Plug Gages are available with Taper Lock or Trilock design. In Standard Hardened Steel, Electrolized, or Carbide for exceptional wear resistance.



T-P Thread Ring Gages Simple unit clamping device simplifies setting, increases accuracy, eliminates distortion. Locks without changing pressure on ring.

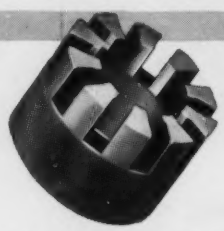


T-P Adjustable Thread Snap Gages Available with Tungsten Carbide anvils. Roll Thread Snaps give longer service life. Gaging members rotate to spread wear over greater surface.

Special Gages



T-P Taper Plug Gages are made to both standard and special tapers. Like T-P Taper Ring Gages they can be made in a wide variety of materials to fit the job.

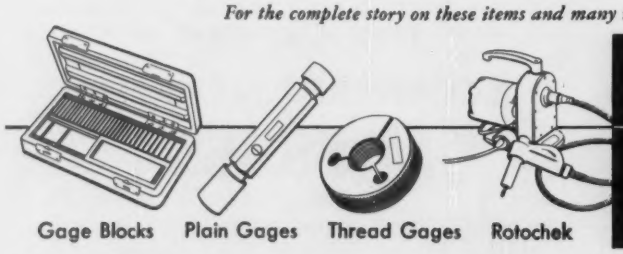


T-P Spline Gages, male and female, are made to individual requirements. Thousands of such special gages are made at Taft-Peirce every year.



T-P Special Snap Gage checks narrow groove in large diameter shaft. Another typical example of the wide variety of special gages made at Taft-Peirce.

For the complete story on these items and many more, send for your copy of the Taft-Peirce Handbook.



Gage Blocks Plain Gages Thread Gages Rotochek

T-P means Top Precision

T P

THE TAFT-PEIRCE MANUFACTURING COMPANY, WOONSOCKET, R. I.

For more information on products advertised, use Inquiry Card, page 243

8 reasons why you should

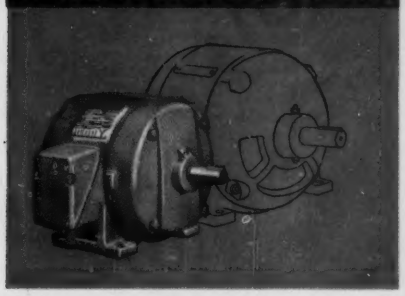
MODERNIZE EQUIPMENT WITH TRI 55 CLAD MOTORS

REG. U.S. PAT. OFF.

Plan now to modernize your equipment with the all-new General Electric Tri/Clad '55' motor, available now in many ratings; entire line of 1 to 30 hp a-c motors available soon. Contact your G-E Representative. General Electric Company, Section 648-6, Schenectady 5, N. Y.



MORE POWER PER POUND



Lighter and smaller Tri/Clad '55' motors in new NEMA frame sizes and ratings save you space and weight, reduce handling costs.

BUYER PREFERENCE



You take advantage of a 2 to 1 buyer preference for the electric motors on your equipment when you buy or specify a G-E motor.

BETTER PERFORMANCE



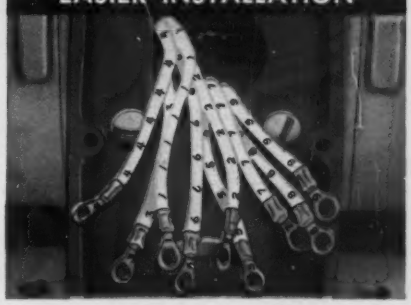
Quieter operation, proved by sound-room tests, is typical of the many performance improvements in the new G-E Tri/Clad '55'.

LONGER LIFE



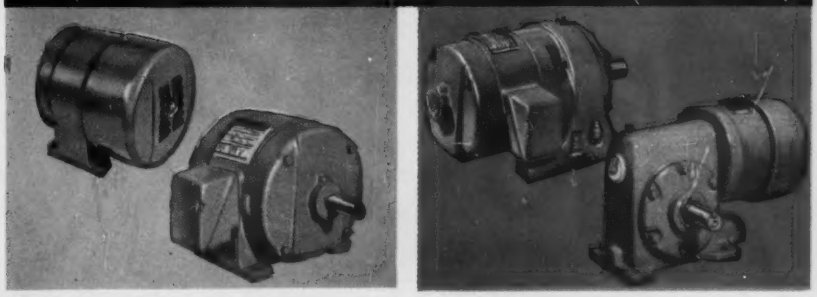
A silicone Dri-film* coating makes insulation shed water—lengthens motor life. Polyester-film insulation is 8 times stronger.

EASIER INSTALLATION



Perma-numbered leads are always instantly read even when wires are taped or clipped. Conduit box has plenty of knuckle room.

COMPLETE LINE OF NEW MOTORS



A complete line of new motors assures the right electrical drive for your machine. Write for Bulletin GEA-6013 on dripproof motors, GEA-6012, on enclosed motors. For low speed jobs, G.E. offers a complete line of gear-motors. Write for Bulletin GEA-6027.

NEAR-BY SERVICE



G-E service is as close as your telephone. Authorized motor service stations provide repair-facilities in all major trading areas.

*Reg. trade-mark of General Electric Co.

Progress is our most important product

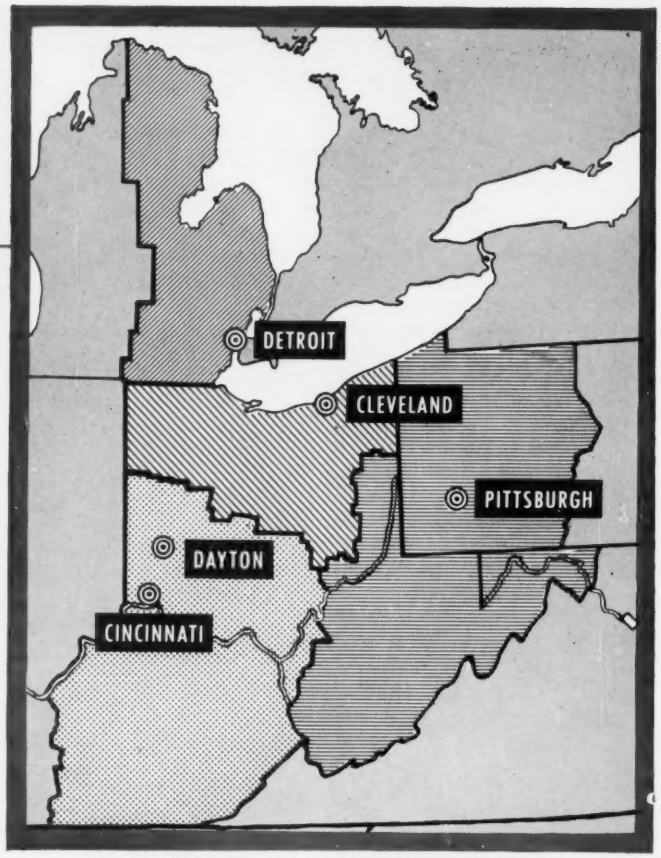
GENERAL ELECTRIC

Fifty Years
1904 • 1954

MOTCH & MERRYWEATHER—

an organization which has served the metal-working industry since 1904.

FIFTY YEARS ago in September, this company was founded as a distributor of machine tools in Ohio and eastern Michigan. Now in the second generation, its operations have broadened to provide a complete machine tool and cutting tool service:



Motch & Merryweather's five offices are located in the heart of industrial America.

- AS *DISTRIBUTORS* OF MACHINE TOOLS AND CUTTING TOOLS:
  Machine Tool Distributor Division
  Cutting Tool Distributor Division
  } *in area shown on map.*
- AS *MANUFACTURERS* OF MACHINE TOOLS AND CUTTING TOOLS:
  Machinery Manufacturing Division
  Cutting Tool Manufacturing Division
  } *represented nationally by distributors.*
- AS *REBUILDERS* OF MACHINE TOOLS:
  Used Machinery and Rebuilding Division — *also nation-wide.*

The last fifty years have seen phenomenal progress in America and throughout the world. In those advances the machine tool industry has played a foremost role. Whatever contribution Motch & Merryweather has been privileged to make can only be an incentive toward continued effort in the same direction during the half century ahead. . . May we serve you?

THE MOTCH AND MERRYWEATHER MACHINERY CO.
CLEVELAND CINCINNATI DETROIT PITTSBURGH

OUR NAME PLATE—symbol of quality for 50 years.

THE MOTCH & MERRYWEATHER MACHINERY CO.

Main Offices and Plants, Cleveland, Ohio

DETROIT • PITTSBURGH • CINCINNATI • DAYTON

For more information on products advertised, use Inquiry Card, page 243



Taps Without a Name

These nameless taps have been closely controlled at every operation back to where they were cut off as blanks from a steel bar.

They should be, and probably are, perfect, *but* before they earn the right to bear the trade mark GTD they must pass this last test. The one on the lead tester already has passed within the plus or minus five ten-thousandths of an inch specified for one inch length of thread.

It'll do a good job for somebody! Maybe *you!*

Greenfield TAP AND DIE CORPORATION, GREENFIELD, MASSACHUSETTS

NEW and BETTER!

PARALLOC DIAL SNAP GAGES

PARALLELISM PRESERVED

STANDARD'S new PARALLOC Dial Snap Gages introduce a new type of locking mechanism which maintains remarkably close parallelism between the anvil faces. Ordinary locking mechanisms tend to distort a portion of the frame in a way which swings the pin faces out of parallelism to a degree which is substantial in relation to close tolerances. In PARALLOC, the metal is merely squeezed *along the line of the pin axis,* leaving the parallel condition undisturbed throughout successive relockings of the anvil. *You can rely on parallelism with PARALLOC!*

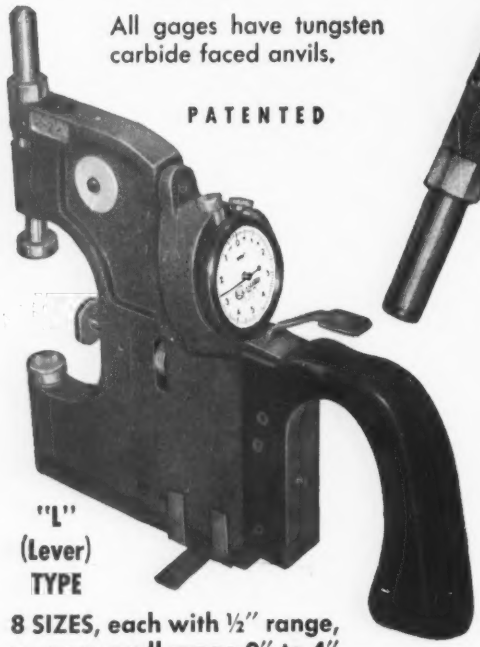


"D" (Direct) TYPE

8 SIZES, each with 1" range, cover overall range 0" to 8"

All gages have tungsten carbide faced anvils.

PATENTED



"L" (Lever) TYPE

8 SIZES, each with ½" range, cover overall range 0" to 4"

- ★ **PARALLELISM of anvils maintained, unaffected by tightness of clamping.**
- ★ **CHOICE OF INDICATORS . . . any AGD indicator in sizes 1 or 2, with desired dial graduations.**
- ★ **TRIPLE PROTECTION; Protective indicator guards; "Capstan" sleeve acts as stop to keep gaging plunger within range of indicator, preventing distortion of indicator mounting; STANDARD's fully shockproof mechanism within indicator protects gears from damage.**
- ★ **ANVILS OVERHANG frame slightly to allow gage to be entered into narrow places and close to a shoulder.**

INDICATOR POSITION permits easy entry of gage into narrow recesses. Advantageously placed for observation.

FULLY ENCASED MOVEMENT AND INDICATOR protected against accidental damage.

CLIP-ON STAND holds gage firmly upright.

WRITE for new booklet, "NEWS", describing these and other new STANDARD developments.

STANDARD Gage Co., Inc.
Poughkeepsie, N.Y.

For more information on products advertised, use Inquiry Card, page 243

CARRIER incorporates a long-range replacement program as part of its over-all capital budget each year



"Constant emphasis on efficient production facilities meeting stringent cost analysis standards is basic to the health of a well-run competitive industrial corporation," according to Cloud Wampler, President of Carrier Corporation. "Carrier incorporates a long-range replacement program as part of its over-all Capital Budget each year. Determining factors in expenditure of funds for each item are: maintenance costs, obsolescence, parts run on machine, future expectations and load and capacity analysis among others.

"Equipment included in the long-range program must be fully justified in respect to these considerations before funds are released. All maintenance and servicing expense for each piece of equipment are kept in a card system. Justification is worked out through review with maintenance, production, scheduling and development personnel, to set up the most effective replacement purchasing program for each year."

CLOUD WAMPLER, *president*
CARRIER CORPORATION

Rockford Insert Group

Keep gathering metal-working production ideas . . . be well informed when the time for replacement arrives.

September, 1954

For more information on products advertised, use Inquiry Card, page 243

300 H.P. and 60" FEED

with Shear Clear Face Mills



These 14" Ingersoll carbide Shear Clear Face Mills, powered by two motor-driven heads of 150 h.p. each, are shown removing 7/16" of cast iron at feed rates of 60" per minute, more than three times the former rate. This roughing cutter can take up to 1-1/8" of tough metal.

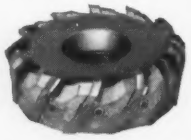
Few Ingersoll customers will require 300 h.p. and the cutting capacity of these specially-designed heavy duty cutters. However, the experience gained through unusual operations such as this is reflected in the constant improvement of Ingersoll's standard line of inserted blade milling cutters.

Many of these design advancements, including the use of new cutting angles, are incorporated into the Ingersoll Shear Clear Face Mill. The patented Ingersoll Shear Clear will out-perform all other types of face mills. Its free cutting, shearing action permits much higher feed rates, gives you smoother finish and longer tool life.

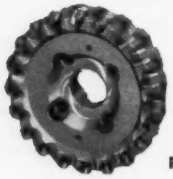
Here are some of the many types of Ingersoll Shear Clear Face Mills. Each Shear Clear has been developed for a particular class of work and has variations in cutting angles and blade materials for different metals. All Shear Clear Cutters offer the economies of inserted blade design, and can be furnished in various sizes with carbide-tipped, cast alloy or high speed steel blades.



For General Purpose Milling



For Aluminum



For Steel



For Light Cuts of Cast Iron



For Heavy Cuts of Cast Iron



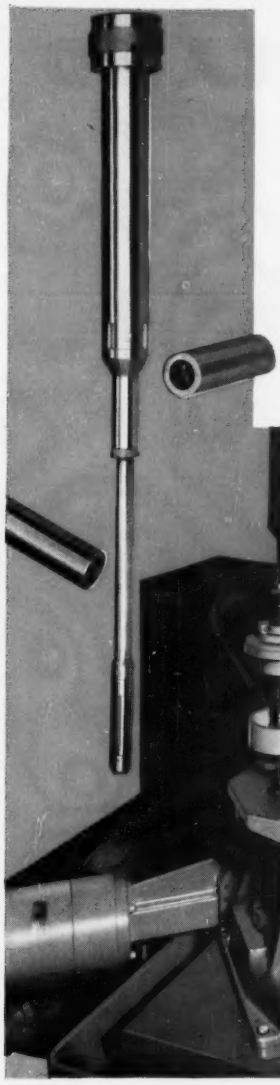
Write Today for Ingersoll Cutter Catalog No. 608.

THE INGERSOLL MILLING MACHINE COMPANY
ROCKFORD, ILLINOIS, U. S. A.

BUILDERS OF SPECIAL DESIGN MILLING & BORING MACHINES
ORIGINATORS OF SHEAR CLEAR CUTTERS



MACHINES DESIGNED TO MEET YOUR NEEDS ROCKFORD, ILLINOIS, U.S.A.



these three features

EXCLUSIVE ON BARNESDRIL HONING EQUIPMENT

reduce your finishing costs on small parts

1. Plugmatic Bore-To-Bore Sizing, within .0005".
2. "Extra-Deep" Plas-T-Clad Stones for 200 to 500% greater abrasive life.
3. Electronic Hone Expansion for peak efficiency and compensation for stone wear.

here's how they work:

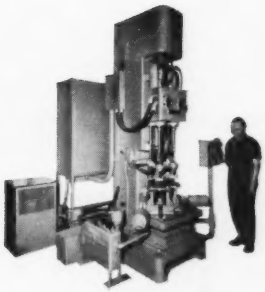
These Aircraft Piston Pins are a typical example. Here a Model 223 Two-Spindle Machine, equipped with special table and air-operated fixtures, rough and finish hones the pins to a .824 ID. These pins have counterbored ends ⅞" deep.

Plugmatic Sizing automatically controls the honing of each bore so that all diameters are identical within .0005".

BARNESDRIL abrasive honing stones are designed with Plas-T-Clad jackets to provide support by the tool body as close as possible to the cutting edge. This design also permits greater usable stone depth, providing 200 to 500% more stone life.

Electronic Hone Expansion combined with the proper abrasive produces an 8 R.M.S. finish.

Only BARNESDRIL Honing Machines put these money-saving, cost-cutting features on your production line. Write or phone for a BARNESDRIL honing engineer to help you apply the honing operation most productively.



HOLE BARNESDRIL FINISHING

BARNES DRILL CO.

820 CHESTNUT STREET • ROCKFORD, ILLINOIS

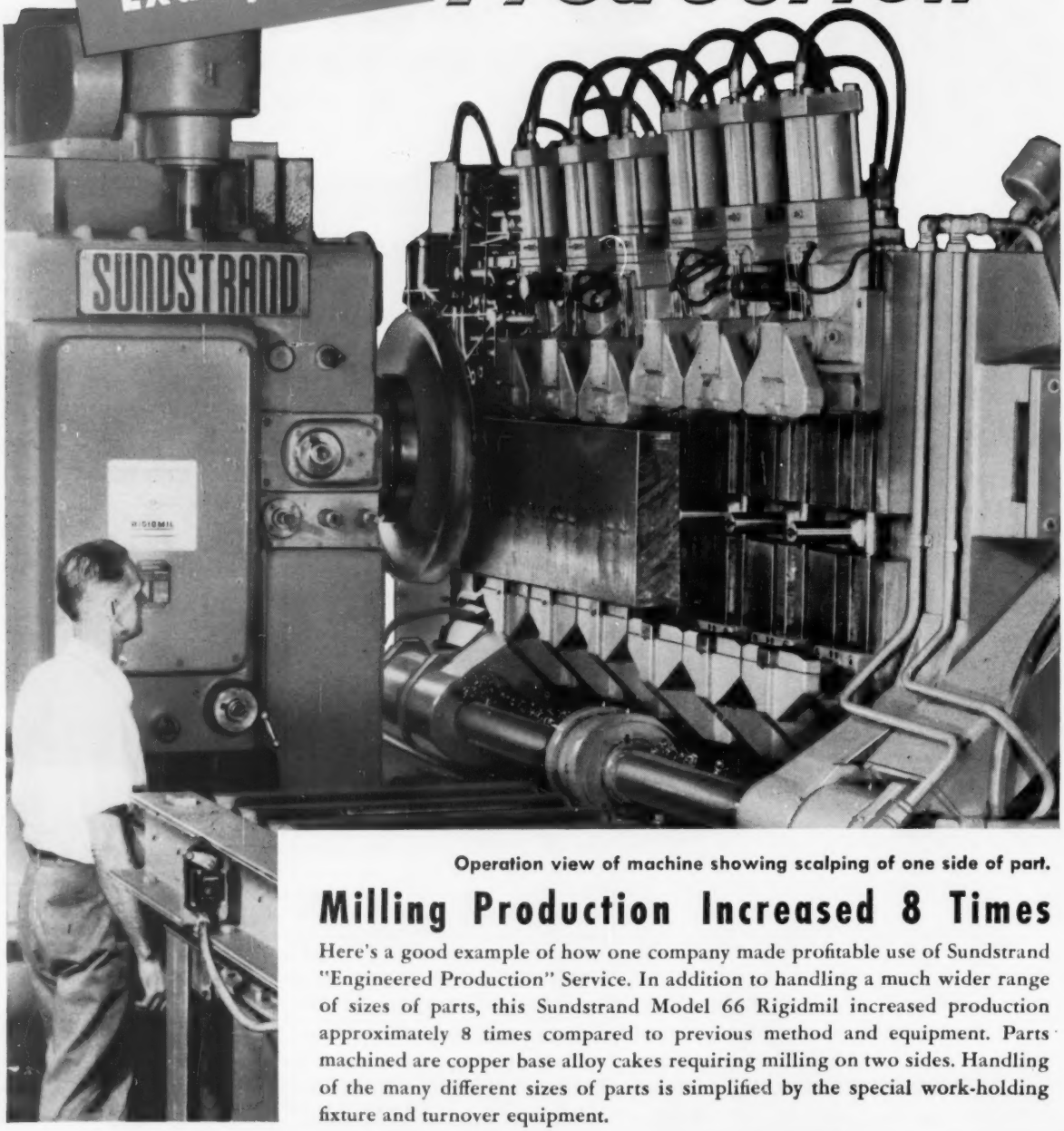
FOR PRODUCTION MACHINE TOOLS IT'S **ROCKFORD, ILLINOIS, U.S.A.**



MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**

SUNDSTRAND

Another Example of "Engineered Production"



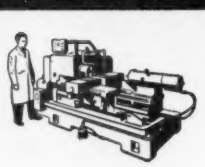
Operation view of machine showing scalping of one side of part.

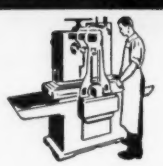
Milling Production Increased 8 Times

Here's a good example of how one company made profitable use of Sundstrand "Engineered Production" Service. In addition to handling a much wider range of sizes of parts, this Sundstrand Model 66 Rigidmil increased production approximately 8 times compared to previous method and equipment. Parts machined are copper base alloy cakes requiring milling on two sides. Handling of the many different sizes of parts is simplified by the special work-holding fixture and turnover equipment.

SUNDSTRAND "Engineered Production" Service*
*REG. U.S. PAT. OFF.

AUTOMATIC LATHES | SIMPLEX RIGIDMILS | DUPLEX RIGIDMILS







CENTER OF MACHINE-TOOL EXCELLENCE **ROCKFORD, ILLINOIS, U.S.A.**

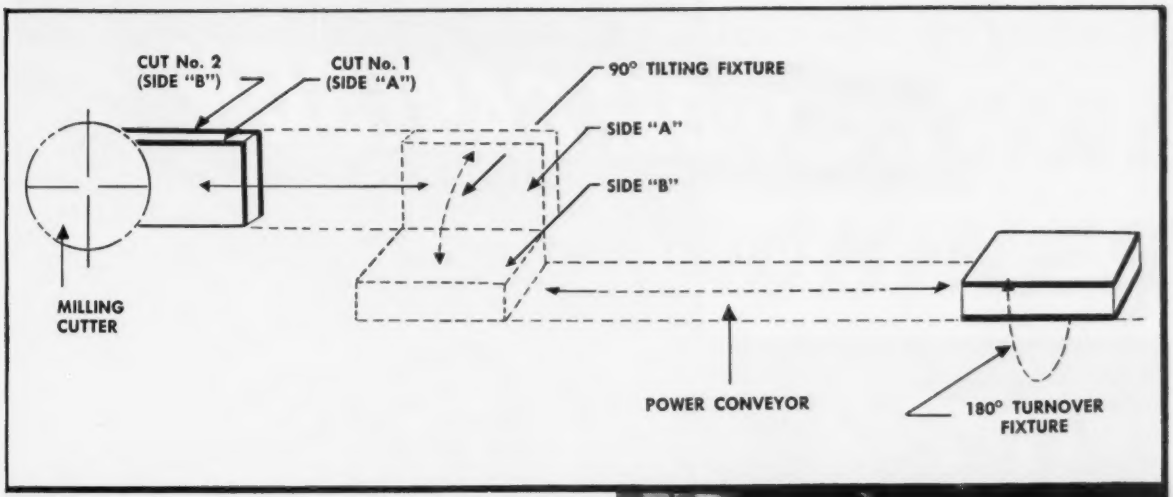
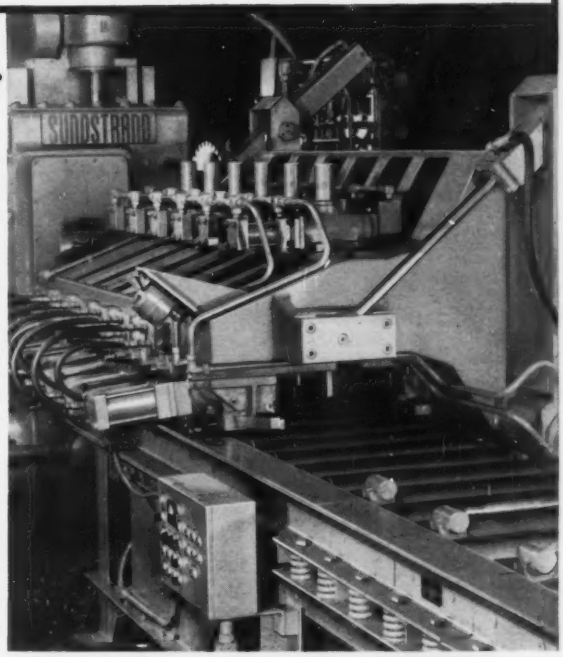


Diagram illustrating sequence of operations.

Close up of work-holding fixture in pick-up position. →



The complete cycle is controlled by the operator from a push button station. First the cakes are loaded onto the conveyor by crane. Then the hydraulically operated fixture is lowered and cake guided into clamping position on power-driven rollers. With the part clamped, the fixture is raised and fed past a 30″ diameter cutter for face milling one side. The fixture then rapid returns to its starting position and pivots down to the conveyor rollers. The clamps release the work onto the conveyor, and the rollers, now in reverse, carry the cake back into turnover fixture. The turnover fixture rotates 180° and places cake back on the rollers and the cycle is repeated for milling opposite side.

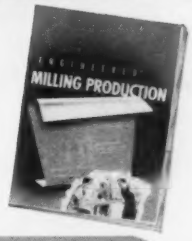
Use Sundstrand "Engineered Production" Service



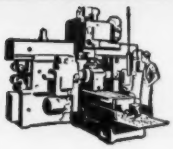
This is but one of many examples of the practical application of Sundstrand "Engineered Production" Service. This same service is available to you without obligation.

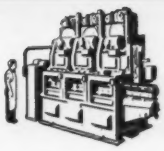
Free Data

Additional information on Sundstrand "Engineered Production" Service as applied to milling problems is included in this booklet. Write for your copy today. Ask for bulletin 647.



TRIPLEX RIGIDMILS | SPECIAL MACHINES





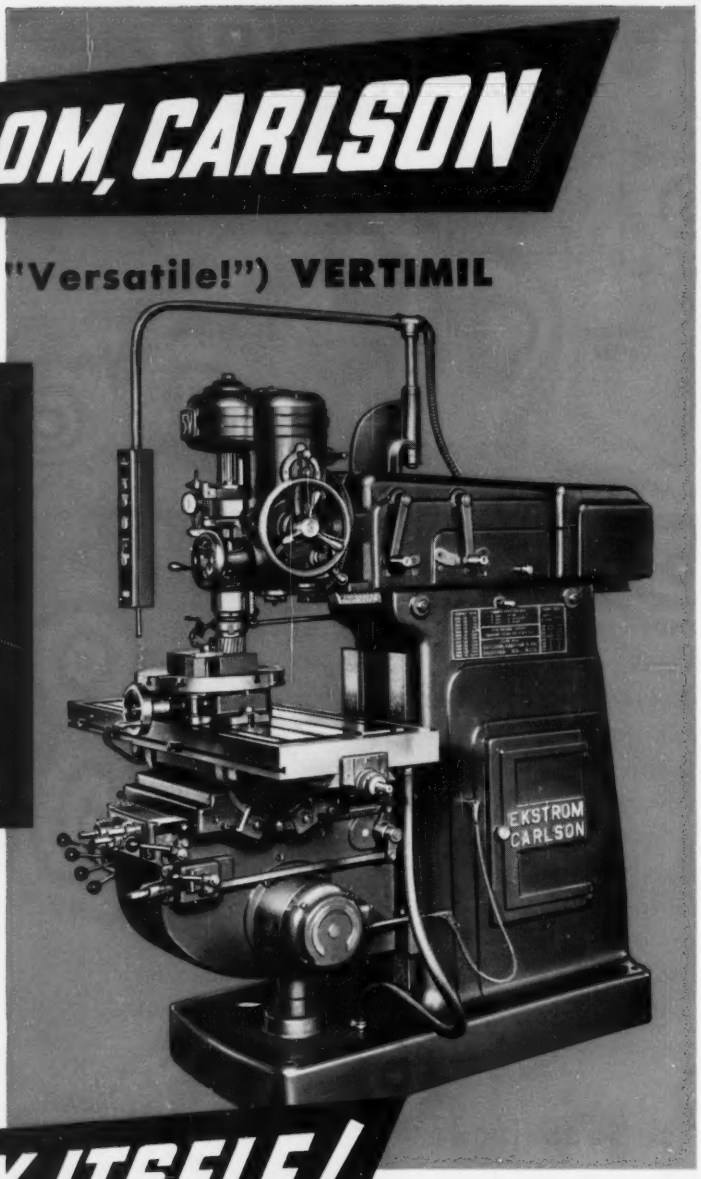
SUNDSTRAND
Machine Tool Co.
2530 Eleventh St. • Rockford, Ill., U.S.A.

FOR PRODUCTION MACHINE TOOLS IT'S **ROCKFORD, ILLINOIS, U.S.A.**

EKSTROM, CARLSON

No. 5V (for "Versatile!") VERTIMIL





POWER CROSS FEED

POWER VERTICAL FEED
(SPINDLE AND KNEE)

POWER LONGITUDINAL FEED

TILTING TABLE

TILTING SPINDLE

IN A CLASS BY ITSELF!



Write for full details Bulletin 5-V

EKSTROM, CARLSON & CO.
1400 Railroad Ave.
Dept. M-4
Rockford, Ill.

Yes, for all types of toolroom work and many kinds of production work, this machine is *hard to beat!* Ekstrom, Carlson engineers have built into this *one* sturdy machine features which make possible the machining of *compound angles* without shifting the work and without special tooling. The machine also is excellent for precision boring, drilling, and milling.

Rapid traverse, broad spindle speed range, spindle motors up to 25 hp, and centralized controls — all add up to more work at less cost. Investigate today!

MANUFACTURERS OF MACHINERY AND TOOLS SINCE 1904

FOR PRODUCTION MACHINE TOOLS IT'S **ROCKFORD, ILLINOIS, U.S.A.**

PRODUCTION MACHINERY

REDUCING COSTS WITH

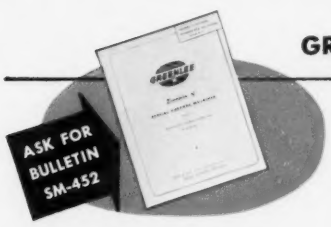
GREENLEE SPECIAL MACHINES

Tomorrow's production requirements demand Special Production Machines — and Greenlee is prepared, by long experience and with ample facilities, to meet a wide range of these needs today. Every Greenlee Special Production Machine is designed to reduce manufacturing costs by combining operations, eliminating work-handling, improving uniformity and accuracy, and cutting machining time. In addition, Greenlee designers often introduce methods which permit savings in following operations.

Because of such cost-reducing features, each machine is justified as an investment by the return that can be expected. This has proved to be surprisingly high with many Greenlee units.

So, where the work calls for any mixture of drilling, boring, and tapping operations, we urge you to *consider Greenlee.*

GREENLEE BROS. & CO., 1869 Mason Ave., Rockford, Ill.



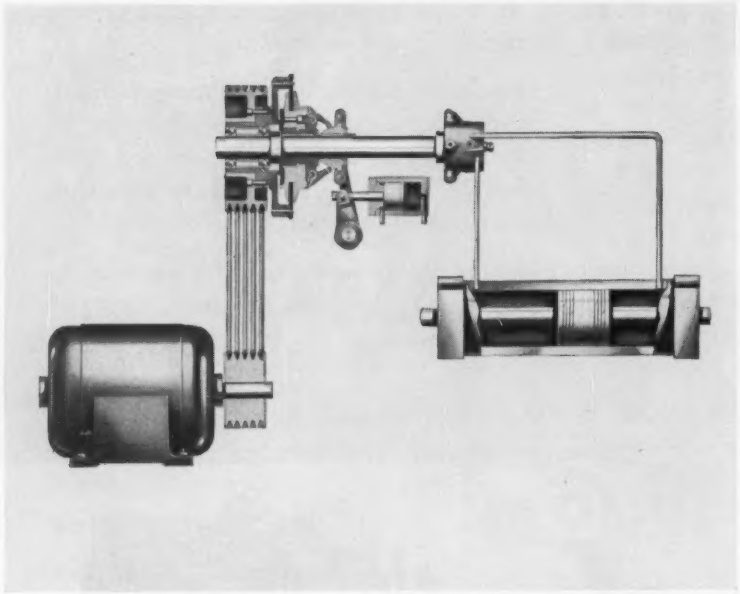
TRANSFER MACHINE

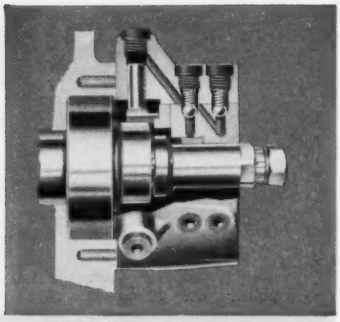
This is a 15-station machine performing 251 operations in a cycle time of 37.2 seconds to deliver 77 Cylinder Heads per hour. Several unique units are included in this design, to perform some unusual operations.

FOR PRODUCTION MACHINE TOOLS IT'S **ROCKFORD, ILLINOIS, U.S.A.**

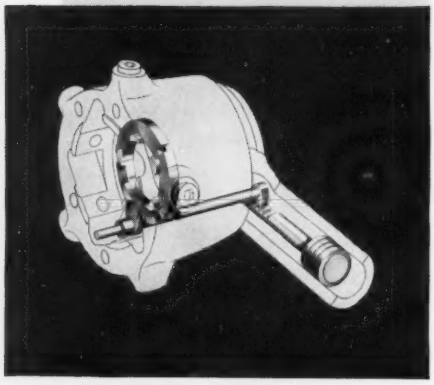


BARNES closed fluid circuit with intermittent drive and control









Fluid power circuit associated with automatic clutch arrangement including a rotary driving means, a variable flow displacement pump driven by the driving means, fluid power action for controlling the clutch arrangement, a fluid motor of the piston and cylinder construction including responsive fluid pressure arrangement within the fluid motor for determining the starting and stopping of the rotary driving means in synchronized relation with direction of travel of the fluid motor.

Result automatic and positive control of the rotary driving means and a predetermined amount of travel of the fluid motor for each revolution of the driving means—irrespective of the amount of resistance encountered by the fluid motor.

BRANCH OFFICES

503 New Center Building
Detroit 2, Michigan
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132 East Hanover Street
Trenton 8, New Jersey

SALES REPRESENTATIVES

Rees Machinery Company
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Pittsburgh 22, Pennsylvania

B. W. Rogers Company
850 South High Street
Akron 9, Ohio

Standard Machine & Tool Co.
870 Ottawa Street
Windsor, Ontario, Canada

W. H. Del Mar Co.
3931 W. Slawson Ave.
Los Angeles 43, California

JOHN S. BARNES CORPORATION / ROCKFORD, ILLINOIS

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MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**

Downtime BECOMES *Production Time*

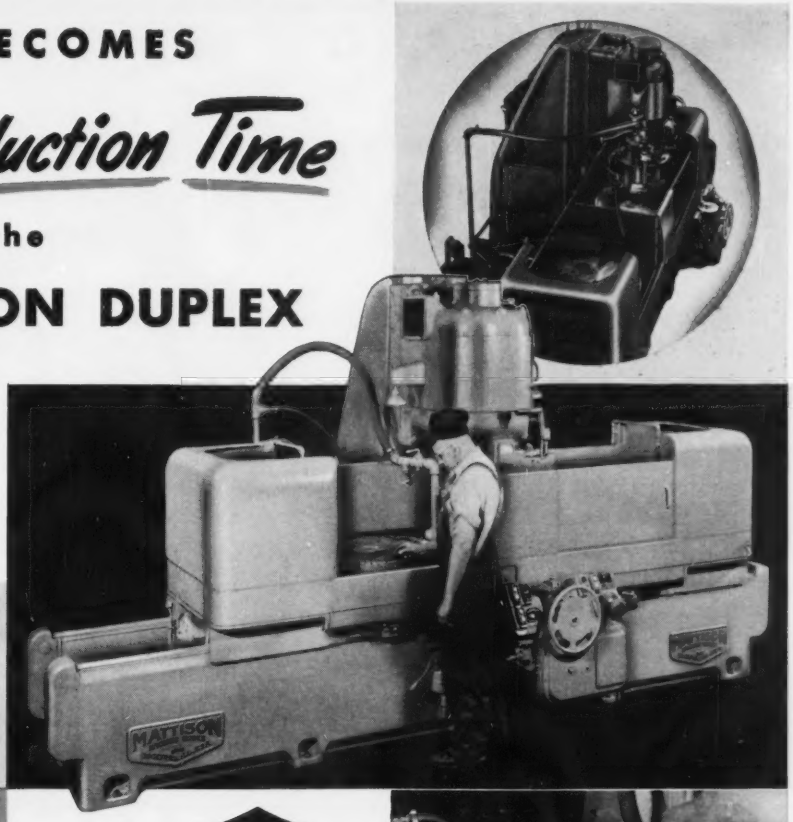
with the

NEW MATTISON DUPLEX

Take a look at **THIS**

~~2 Operators~~
~~2 Standard Grinders~~
~~500 Pieces~~

1 Operator
1 Mattison Duplex
500 Pieces





● That's what happened at The Ingersoll Milling Machine Co., where modern shop equipment is playing an important part in meeting greatly increased requirements for Ingersoll milling cutter blades.

They say "The pieces being ground in these pictures are Maxel steel shanks for carbide-tipped milling cutter blades.

On these particular blade shanks, .050 stock is removed on the Mattison Duplex. A wide variety of blades and shanks are ground on this machine, with stock removal ranging from .020 to .200.

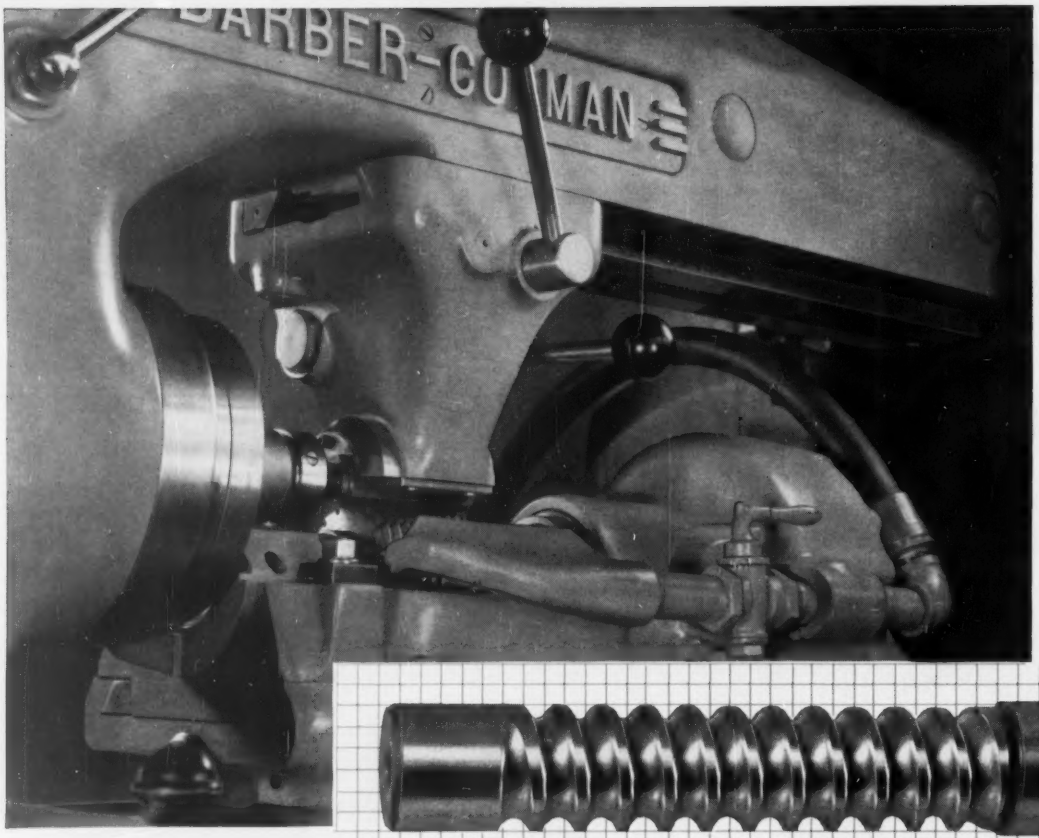
The two Mattison Duplex machines which replaced three single-table standard type grinders are doing more work than the three replaced machines. By placing a single ring of blades around the outside of the 30″ diameter chuck, the operator is able to maintain continuous grinding. If more blades were put on the table at one time, the blades on the other table would be finished before he was ready to unload them.

The time saving in rough grinding these blades on the new Duplex machines is 50 per cent, compared with the old machines. In other words, 500 blades can be produced in half the time formerly required. Greater power and faster action account for some of this difference.

The new Mattison Duplex Grinder is really two machines in one, being equipped with two rotary tables or chucks instead of one. On many classes of work, one operator with this machine can turn out as much work as was formerly done by two machines and two operators. See example to the left. Downtime is practically eliminated.

An analysis of your grinding work will very likely disclose many jobs that could be very profitably handled on a Mattison Duplex. For further information write for a free copy of 145-3RM our new circular on this machine.

MATTISON MACHINE WORKS
ROCKFORD · ILLINOIS



Standard Hobbing Machines Solve Special Problems

standard barber-colman machines with special tooling cut internal and external threads

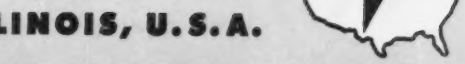
The wide range of versatility to be found in the basic design of Barber-Colman Hobbing Machines is illustrated by these internal ball nut and worm shaft threading applications. Standard units and assemblies are used wherever possible for these special applications.

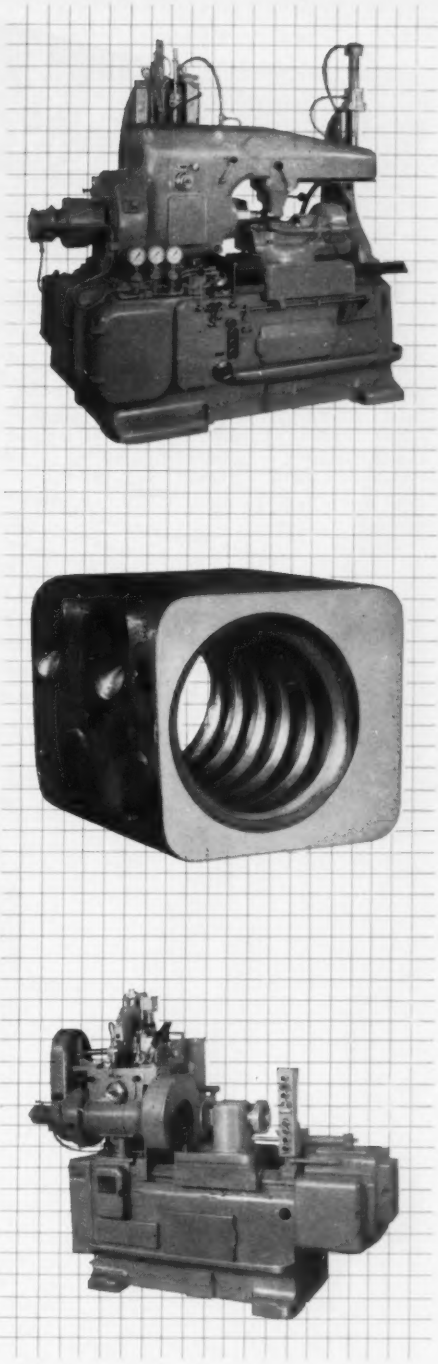
A standard No. 14-15 Hobbing Machine has been equipped with a special hob slide, special work support bracket and modified gear train to thread mill this worm shaft steering part with ease and production economy.

Likewise, a standard No. 16-16 hobbing machine, with special work slide, hydraulic holding equipment, cam vertical feed and special cutter slide replacing the conventional hob slide, is arranged for internal thread milling the ball nut mating part.

These jobs are examples of special applications which can be adapted to standard hobbing machine operation through special tooling and machine arrangements.

B U I L D E R S O F P R E C I S I O N G E A R





thread milling the worm

For milling the worm threads, the hob slide is equipped with a thread milling cutter and is positioned 90° from standard, so that the cutter spindle is parallel with the work spindle. The gear train has been modified so that feed and index gears advance the cutter properly to cut the worm threads. The work center bracket support has been designed to provide maximum rigidity of the work piece during the cutting operation. Vertical feed is used to plunge cut to depth, and then the cutter is fed axially to finish the thread.

milling internal threads on the mating part

The machine used to mill the internal threads on the mating part is a special No. 16-16 Hobbing Machine, with special cutter slide positioned permanently so that the cutter spindle is parallel with the work spindle. The gear train has also been modified to advance the cutter in proper relation to the worm threads. Hydraulic holding equipment is employed to clamp the ball nut in position for milling. Clamp and release are operated conveniently by a control valve located on the work slide upright.

Since the No. 16-16 Machine basically does not include vertical feed this arrangement has been added through cam action. A shank-type cutter with special outboard pilot support to steady the cutting action is used, since a small diameter cutter is needed for the internal cut.

When you have problems of producing special forms, equally spaced on a cylindrical base, within the range capacity of standard Barber-Colman hobbing machines, consult our engineers for suggestions on how you may adapt this type of equipment for efficient, economical production. We'll be glad to discuss the adaptation of these machines to meet any of your requirements. Just send us prints or specifications for analysis.

HOBS • CUTTERS • REAMERS
HOBBING MACHINES
HOB SHARPENING MACHINES

BARBER COLMAN

Barber-Colman Company

GENERAL OFFICES AND PLANT, 820 ROCK STREET, ROCKFORD, ILLINOIS

HOBS AND MACHINES SINCE 1911



FASTER CHECKING . . . STRAIGHTENING, BALANCING, SCRAPING

HYDRAULIC POWER PRESS

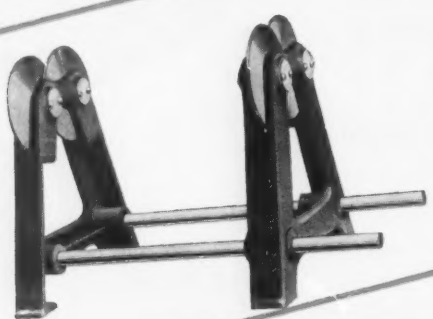
Built with Stationary or Traveling Ram . . . capacities up to 10, 25, and 50 tons . . . so sensitive and accurate that a shaft may be bent .001". Pressure gauge, indicating ram loading . . . adjustable dial indicator shows amount of shaft run-out in pre-loaded, fully loaded, and unloaded positions.

Flexible, sensitive control by rotary control valve operated by hand lever. An infinite range of loading up to capacity as lever is moved from 0 to maximum displacement. Push button control of hydraulic unit. Work table, 60" or 108" long. Available attachments include checking rolls, spring loaded centers, adjustable anvils and indicator. To increase production speed, an adjustable stop collar limits the stroke of the ram.



BALANCING WAYS

For balancing, straightening and truing operations. No leveling or centering required. Simply place part to be tested on the four chilled iron discs rotating on supersensitive ball bearings. Made in five sizes . . . 20" to 96" swing.



POWER SCRAPER

Has a "natural hand control" . . . as easy to use as a hand scraper. Left hand serves as guide to the blade . . . right hand controls the stroke. Pressure of left hand controls depth of cut, but forward cut requires no back-breaking labor. A slight forward pressure on cylinder with right hand starts swift, smooth forward stroke which can be regulated from nothing to 3½ feet . . . 60 feet per minute, reverse speed 90 feet per minute. Operator can work at a steady rate without tiring as ¼ h.p. motor does heavy cutting. With this machine one man can do the work of several. The Anderson Power Scraper, mounted on an elevating truck, is easily moved to any location. Machine may be plugged into electric lamp socket and be ready for use. In scraper housing directly across from motor is a scraper blade grinder . . . a convenient, speedy means of resharpening scraper blades without leaving machine.



Send for Bulletin 11-6

ROCKFORD Anderson BROS. MFG. CO. ILLINOIS

ANDERSON BROS. MFG. CO., ROCKFORD, ILLINOIS

Rehnberg-Jacobson

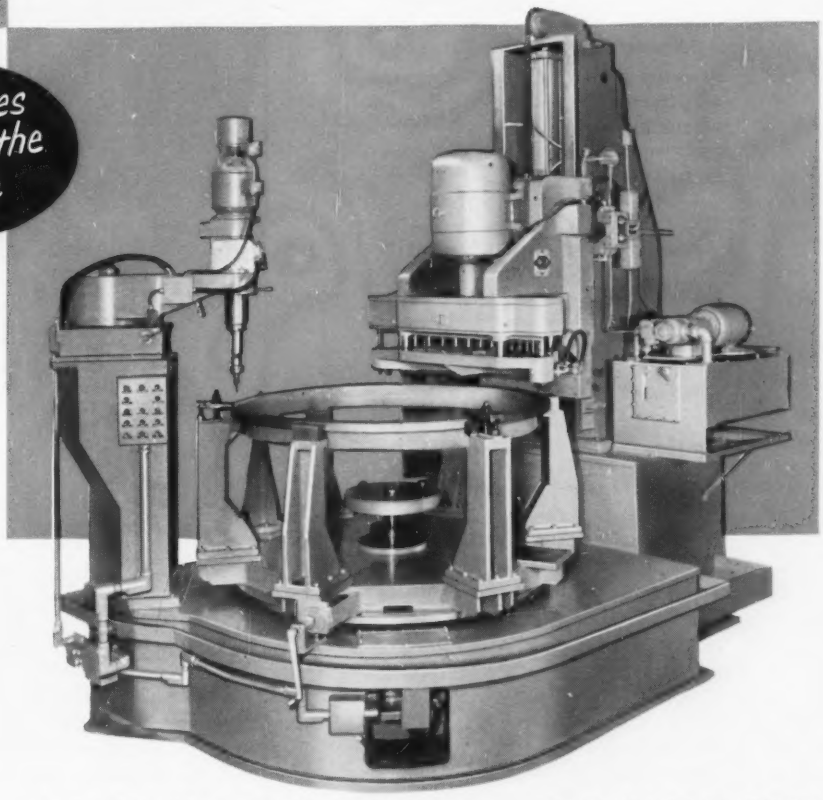
we make LITTLE ONES and BIG ONES



This little machine is specially designed for the rapid and automatic assembly of needle bearings. It features a new and extremely effective hopper for feeding the "needles" more surely and faster than ever before.

. . . and anything in between! On the chance that you are not acquainted with the scope of our work, we illustrate here the approximate limits of the machines we have designed and built. The little machine is less than five feet high and weighs about 350 pounds, the big one is nearly fifteen feet high and weighs 26 tons. When you need a Production Machine that might fall anywhere in this range, be sure to give us a chance to talk over the possibilities with you.

These two pictures are reduced in the same scale



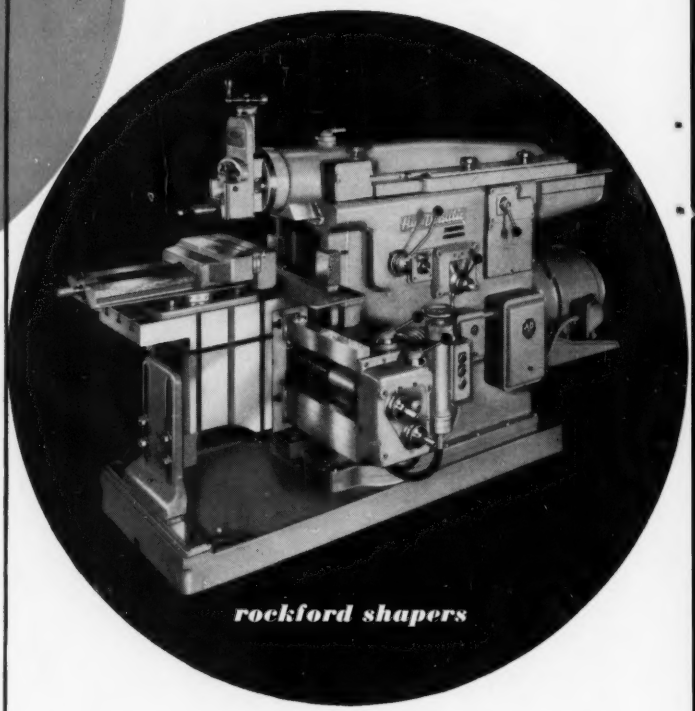
This big machine is designed to handle a highly specialized drilling job on some important parts of a machine that is significant in one of the great new developments of the modern age. The work calls for drilling 60 equally spaced 11/16" holes on a 72" bolt circle, plus drilling and tapping four additional 3/4"-10 holes at equal intervals. One 16-spindle drill head, a single tapping unit, and mechanical table index do the whole job automatically in four steps.

REHNBERG-JACOBSON MFG. COMPANY

DESIGNERS & BUILDERS OF SPECIAL MACHINERY

2135 KISHWAUKEE ST.
ROCKFORD, ILLINOIS

hydraulic design gives you these advantages



rockford shapers

hydraulic design
is noted for its efficiency. Because of direct, straight-line application of smooth-flowing oil under pressure, more metal can be removed per horsepower expended.

finer finishes
are possible with hydraulic drive because it contains no bearings, gears, links or joints, eliminating the possibility of chatter developing and transmitting gear marks to the work.

cutting pressure is uniform
throughout each cut, thus working tools to maximum capacity.

much higher return speeds
are secured after a smooth, shockless reversal.

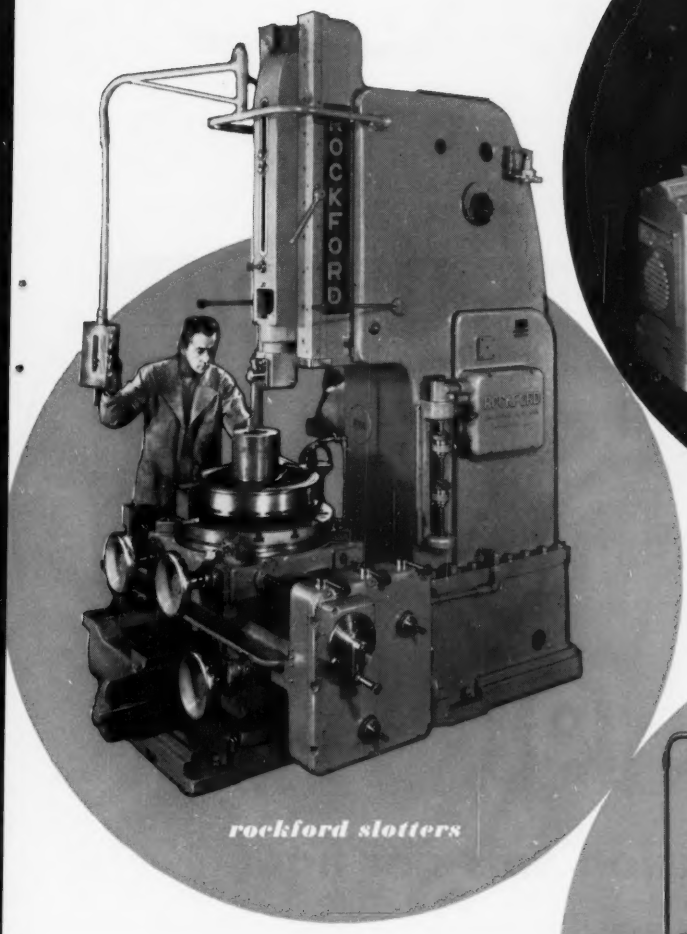
cutting speeds and feeds
may be adjusted exactly to meet the requirements of your particular work, because the rate of these movements can be varied infinitely up to the maximum capacity of the machine. Cutting and return speeds are independent of each other.

automatic lubrication
is an inherent quality of the hydraulic drive.

Ask a Rockford Machine Tool Co. representative to recommend the Rockford Hydraulic Driven Machine Tool for your needs.

our 52nd year

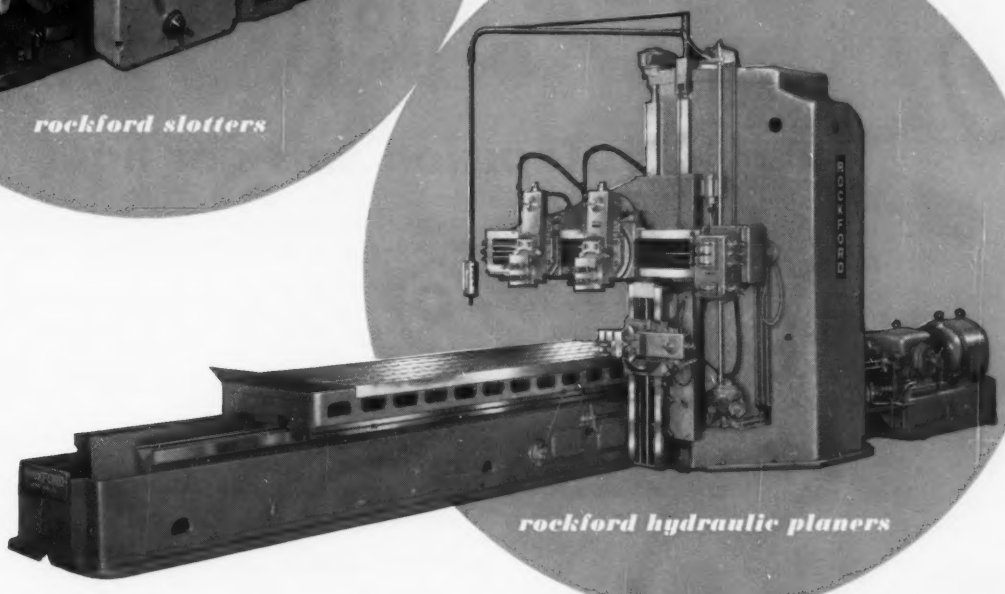
Rockford Machine Tool Co.



rockford slotters



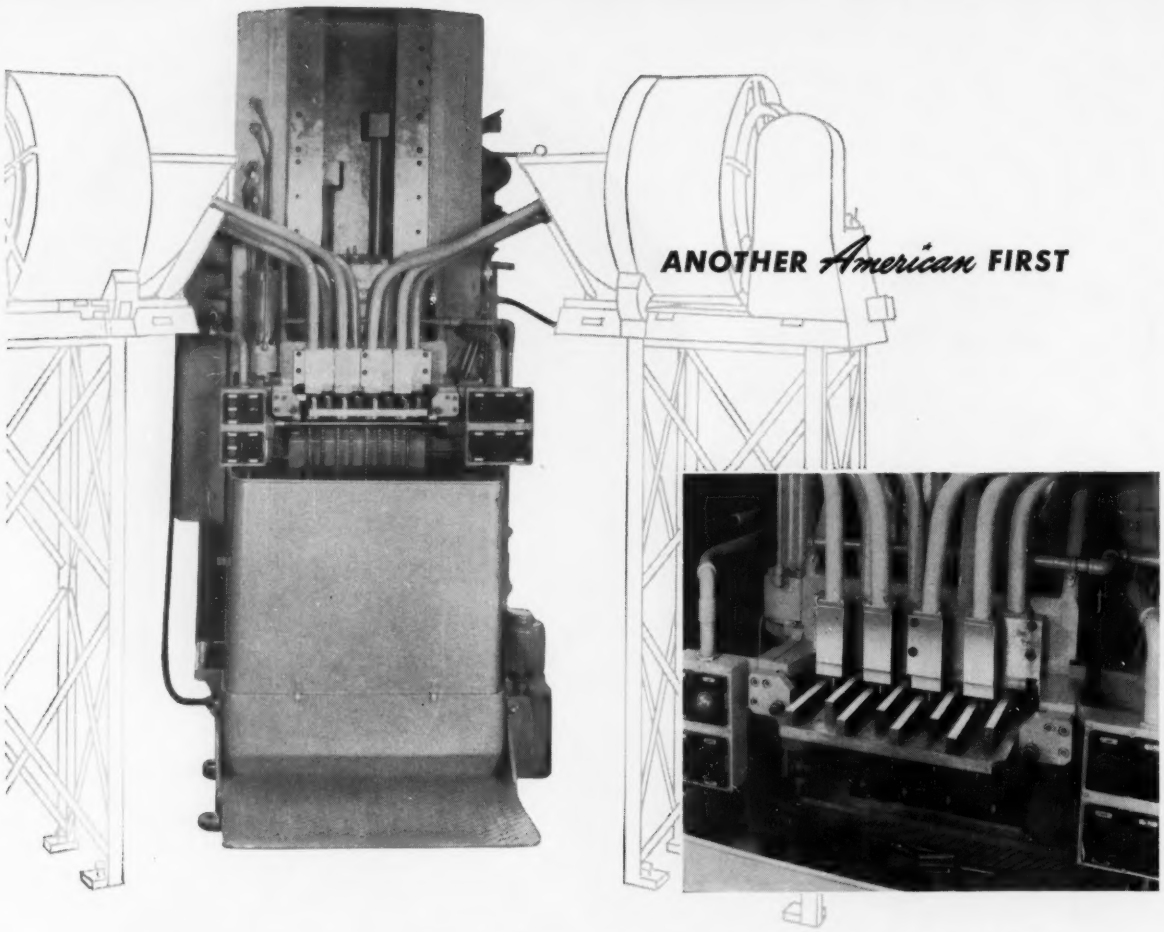
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shaping / planing / duplicating / turning ***Rockford, Illinois***

CITY OF MACHINE-TOOL SPECIALISTS **ROCKFORD, ILLINOIS, U.S.A.**



ANOTHER *American* FIRST

AUTOMATED BROACHING

1600 piston pins per hour



As a metal working process, broaching adapts easily to the new concept of automation — with new highs in productive capacity achieved in a great variety of different applications.

Here, an eight station American vertical pull-up broaching machine, equipped with hopper feeds and hydraulic positioning slide, automatically broaches the ID of automotive piston pins — eight at a time, 1600 per hour. Feed, broaching and parts ejection continue automatically once the machine cycle has been started.

Why not investigate the all-around service that American is equipped to give you on broaches, fixtures and broaching machines. Drop us a line, giving details of your machining problem — catalogs and recommendations will be furnished promptly.

AMERICAN *American* BROACH & MACHINE CO.

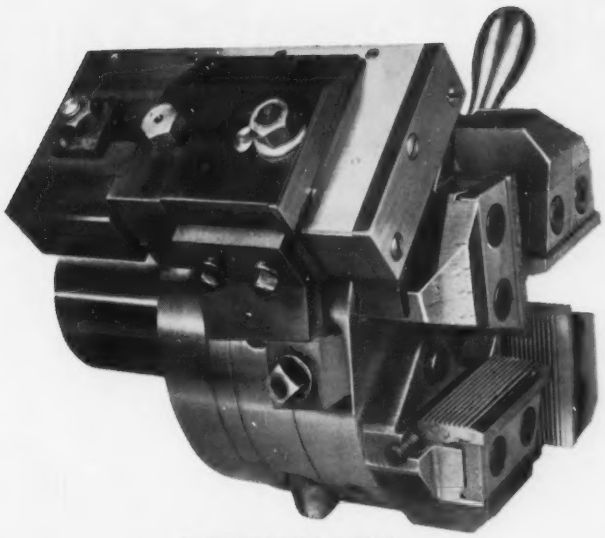
A DIVISION OF SUNDSTRAND MACHINE TOOL CO.

SUNDSTRAND

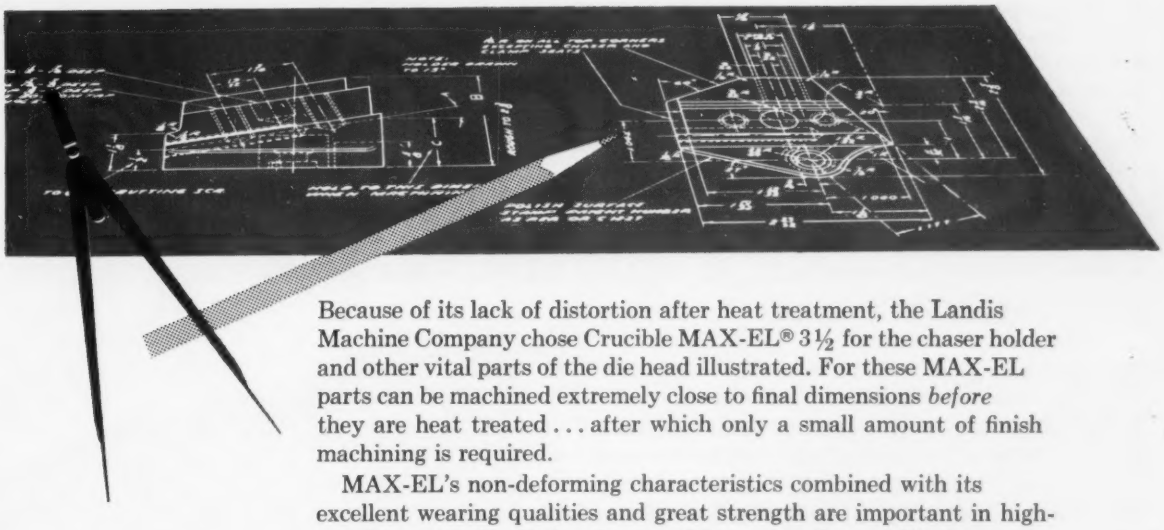
American Building - Ann Arbor, Michigan

See *American* First — for the Best in Broaching Tools, Broaching Machines, Special Machinery

CITY OF MACHINE-TOOL SPECIALISTS **ROCKFORD, ILLINOIS, U.S.A.**



Non-deforming **MAX-EL** alloy steel parts require minimum finish machining



Because of its lack of distortion after heat treatment, the Landis Machine Company chose Crucible MAX-EL® 3½ for the chaser holder and other vital parts of the die head illustrated. For these MAX-EL parts can be machined extremely close to final dimensions *before* they are heat treated . . . after which only a small amount of finish machining is required.

MAX-EL's non-deforming characteristics combined with its excellent wearing qualities and great strength are important in high-speed turret lathe die heads . . . and in many other applications.

Your shop will benefit, too, from the ease of machining, freedom from distortion, superior quality and longer tool life you get with MAX-EL. To start taking advantage of MAX-EL *now, call Crucible.*



CRUCIBLE first name in special purpose steels

54 years of Fine steelmaking **ALLOY STEELS**

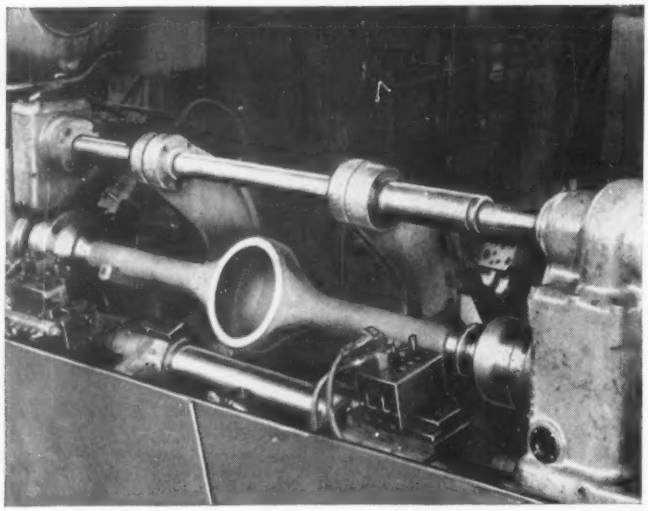
CRUCIBLE STEEL COMPANY OF AMERICA, GENERAL SALES OFFICES, OLIVER BUILDING, PITTSBURGH, PA.

Branch Offices and Warehouses: ATLANTA • BALTIMORE • BOSTON • BUFFALO • CHARLOTTE • CHICAGO • CINCINNATI • CLEVELAND • DAYTON DENVER • DETROIT • HOUSTON • INDIANAPOLIS • LOS ANGELES • MILWAUKEE • NEWARK • NEW HAVEN • NEW YORK • PHILADELPHIA • PITTSBURGH PROVIDENCE • ROCKFORD • SAN FRANCISCO • SEATTLE • SPRINGFIELD, MASS. • ST. LOUIS • ST. PAUL • SYRACUSE • TORONTO, ONT. • WASHINGTON, D. C.

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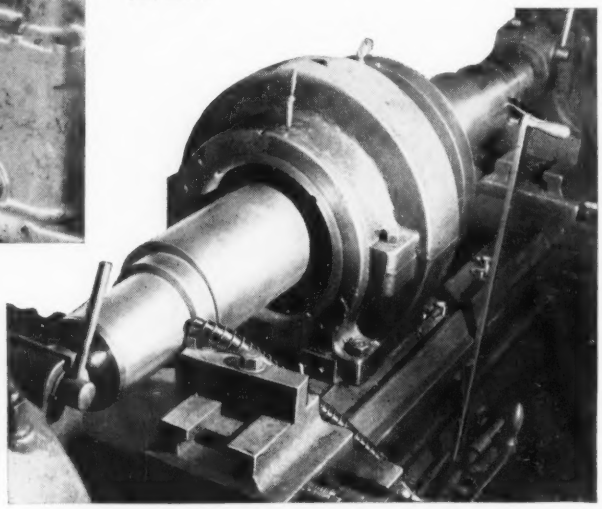
MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**

Hard at Red Heat, and Tough, Too!



IMPACT RESISTANCE PLUS . . .

HAYNES STELLITE tools are tough! They machine 50 of these axle housings per hour, averaging 150 pieces between grinds. Tool wear and chipping are kept at a minimum despite deep cuts and severe workpiece vibration. HAYNES STELLITE tools handle the cuts at high feed rates, while operating at red heat.



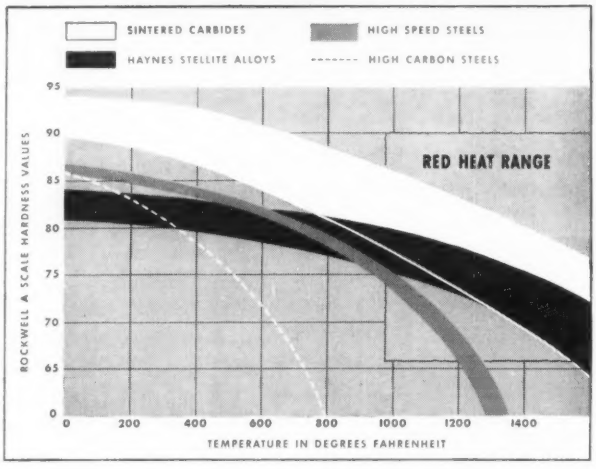
INTERMITTENT CUTTING AT RED HEAT . . .

Machining time on these shafts was cut in half using HAYNES STELLITE tools. The eccentric shafts (SAE 4340 steel) are machined dry, and the tool and chips glow cherry red. The off-center cut, plus the length of the shaft, sets up unavoidable chatter. Harder tools were not tough enough to handle the cut, nor were tougher steel tools effective at red heat. HAYNES STELLITE tools had the combined red hardness and toughness to do the job right.

A COST-CUTTING COMBINATION . . .

This graph shows the hardness properties of HAYNES STELLITE tools. Their high hardness at red heat, combined with their inherent toughness, accounts in part for the fine performance and savings gained through their use.

If your aim is to increase production and cut costs, write today for a copy of "HAYNES STELLITE Metal-Cutting Tools." This manual of tool practice is published as a service to you.



HAYNES STELLITE

Trade-Mark

Metal Cutting Tools

The original cobalt-chromium-tungsten metal-cutting tool.

"Haynes Stellite" is a registered trade-mark of Union Carbide and Carbon Corporation.

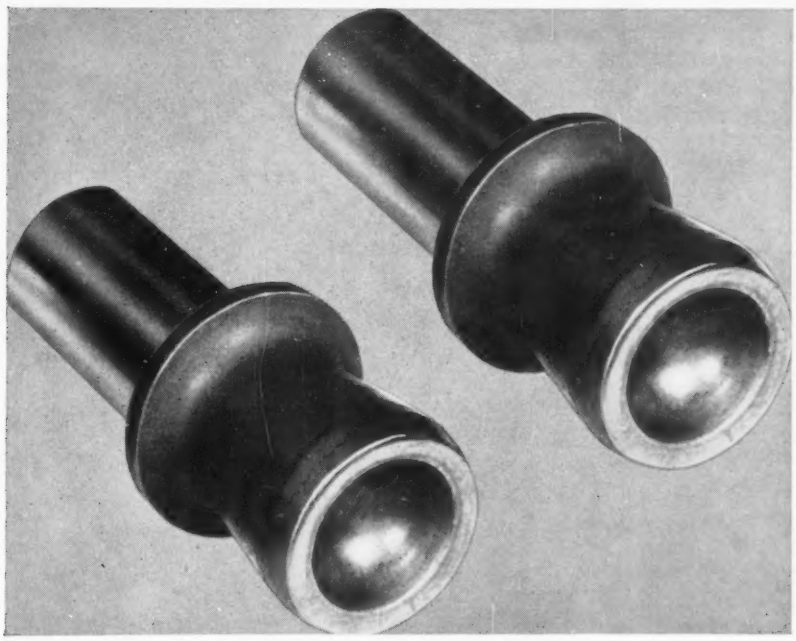
Haynes Stellite Company
A Division of
Union Carbide and Carbon Corporation
UCC
General Offices and Works, Kokomo, Indiana
Sales Offices
Chicago — Cleveland — Detroit — Houston
Los Angeles — New York — San Francisco — Tulsa

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Tool Steel Topics

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation



Boiler Shop Using Bearcat Rivet-Sets Ups Average Run from 300 to 2470

The mechanical department of a large boiler shop had trouble driving more than 300 hot rivets, using standard rivet-sets. Once that mark had been reached, the sets would crack or spall. Sometimes recupping saved the day, but oftener than not the sets had to be replaced.

We were sure they could get longer runs with rivet-sets of Bearcat tool steel. The management gave Bearcat a trial, and put six sets to work after a heat-treatment cycle consisting of preheating at 1200F, air-quenching at 1750, and tempering at 550.

The results were even better than expected. The average run increased from 300 to 2470 before recupping was required. Not only that, but the recupping was accomplished without heat-treatment, which of course is a frequent source of trouble with rivet-sets of carbon tool steel.

Bearcat is an ideal tool steel for the manufacture of rivet-sets because of its superior shock-resistance. It is also well suited for uses where hot-work properties and easy machining are essential.

BEARCAT'S BIG FEATURES

1. Super shock-resistance
2. Deep-hardening . . . in air
3. Machines easily (Brinell 197 max)
4. Low distortion in heat-treatment
5. Good hot-work properties
6. Easily carburized for long wear

Typical Analysis

C	Mn	Si	Cr	Mo
0.50	0.70	0.25	3.25	1.40

In addition to being used for rivet-sets, Bearcat is ideal for such hot- and cold-shock applications as chisels, punches, hot headers and gripper dies. It has many other uses, too — master hobs, engraving dies, die-casting dies, and short-run dies used in cold-forming, blanking and bending.

You'll be well pleased with the service life obtained with Bearcat. We stock Bearcat in our mill depot. Or you can obtain a supply through your local Bethlehem tool steel distributor.

BETHLEHEM TOOL STEEL ENGINEER SAYS:



Use Care When Hardening Hot-Work Tools

Although hot-work tools can be hardened to Rockwell C-56-60, there are hardly any applications where such hardness is beneficial. The majority of hot-work tools are used in a hardness range of C-41-44, or C-46-49. On new hot-work applications, a common mistake is to heat-treat to a hardness level which is too high for the application, with the result that rapid heat checking or breakage occurs.

For example, put tools of our Hot Work 8 analysis to work at C-55 or higher, and chances are, they will fail prematurely. Yet these same tools, used at Rockwell C-52 or lower, will give outstanding service.

On every hot-work application the best hardness level must be determined by experience. There's always a compromise involved, as the highest hardness is best for wear-resistance, and the lowest hardness is more resistant to heat-checks. Our suggestion? To be sure of maximum service, don't overharden hot-work tools.



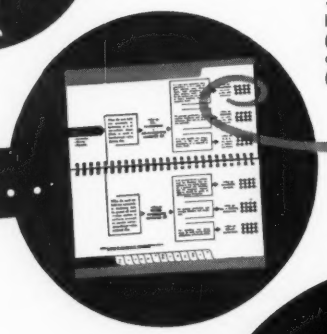
IT'S A-H5 FOR LONG PRODUCTION RUNS

This high-production die, made of A-H5, blanks and punches sheet steel of 0.180-in. thickness. A-H5 makes possible long production runs between grinds. It holds a durable cutting edge, and resists distortion in heat-treatment.

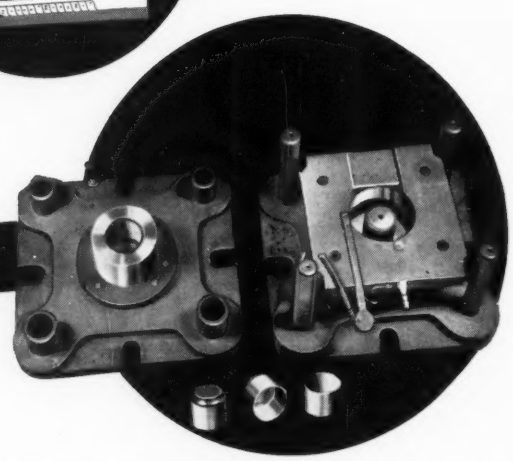
How ONE TOOLMAKER . . .



USED THIS GUIDE . . . . . —then use HAMPDEN (Oil-Wear) or No. 610 (Air-Wear)



TO HOLD DOWN UNIT COSTS . . .



AT which step in your tooling process would you welcome real help in reducing tool and die costs? Tool Steel Selection? Heat Treating?—or on-the-job "Trouble-Shooting"? Here's how you, like the maker of the Dies shown here, can start to reduce costs with a Method that helps you at *all 3* steps.

First, to simplify selection, use the handy Selector Section in the Carpenter Matched Tool Steel Manual. Quickly and surely, it enables you to put your finger on the proper steel for best results. Next, to further insure tool and die performance, use the Manual's complete heat treating instructions—they have been simplified beyond anything previously known. It's easy to get started—use the Carpenter Matched Set Method to help you "trouble-shoot" your present tool and die jobs.

For better, lower-cost tooling, put this practical, easy-to-use Method to work, now. Ask for the 189-page Carpenter Matched Tool Steel Manual—just see your Carpenter representative. The Carpenter Steel Company, 105 W. Bern Street, Reading, Pa.

Job:
Compound Blank and Draw Die for forming .031", ¼-hard brass Vent Valve Bodies at the rate of 103 per minute on a punch press.

Problem:
Unit costs were on the upswing because the old dies wore too rapidly, causing frequent and costly machine shutdowns for regrinding.

Solution:
Looking for a die steel with maximum wear resistance, the toolmaker referred to the Selector Section in the Carpenter Matched Tool Steel Manual, and quickly arrived at Carpenter *Hampden* (Oil-Wear).

Heat Treatment:
Simplified instructions in the Manual were followed.

Results:
2 hours of costly machine downtime were eliminated *each day*—production per grind *rose over 300%!* As a matter of interest, the toolmaker takes off approximately .0005" per stoning and gets about 100 grinds from the Blank and Draw Die.

IMMEDIATE DELIVERY FROM LOCAL STOCKS!

Call Your Nearest Carpenter Warehouse or Distributor

The Standard Tool Steels of Industry

Carpenter STEEL

Matched Tool and Die Steels

Export Department: The Carpenter Steel Co., Port Washington, N. Y.—"CARSTEELCO"

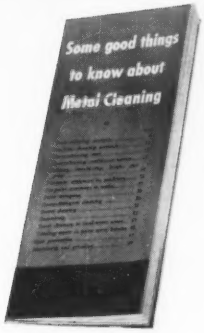
Mill-Branch Warehouses and Distributors in Principal Cities Throughout the U. S. A. and Canada

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Which of these jobs gives you trouble?

Oakite has 7 new ways to help you

Oakite chemists have developed efficient new materials for the seven important jobs listed below. One of these new materials may provide the perfect solution for your most difficult problem.



FREE

Tell us which job gives you trouble (or circle the corresponding number in the coupon). We'll give you information about the new material that does the work, also send you our 44-page illustrated booklet "Some good things to know about Metal Cleaning."

1	**HEAVY-DUTY CLEANING IN TANKS:** New material combines the best qualities of alkaline and solvent cleaners.
2	**CLEANING ALUMINUM IN SPRAY-WASHING MACHINES:** Safe cleaning with minimum foaming whether spray pressure is high or low.
3	**PHOSPHATE COATINGS:** One material cleans steel while applying dense iron-phosphate coating. Another surpasses government specifications for heavy zinc-phosphate coatings. Lasting paint adhesion, protection against corrosion, ease of control.
4	**ETCH-CLEANING ALUMINUM:** Uniform etching in preparation for anodizing or painting. Scaling and sludging minimized or eliminated.
5	**ELECTROCLEANING BRASS:** Efficient, economical cleaning without danger of tarnish.
6	**INHIBITING PICKLE BATHS:** Liquid inhibitor for sulphuric, hydrochloric and phosphoric acids. Saves steel, saves acid, builds own foam blanket to suppress pickling fumes. Easy to add to continuous strip or batch pickling operations.
7	**STRIPPING PAINT:** Two solvent strippers for synthetic enamels and other tough finishes. One so viscous it adheres to vertical surfaces of objects that can't be stripped any other way.

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MATERIALS • METHODS • SERVICE

Technical Service Representatives in Principal Cities in U. S. and Canada

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Send me a FREE copy of "Some good things to know about Metal Cleaning" and tell me more about the new Oakite material for the job (jobs) corresponding to the number (numbers) I've circled below.

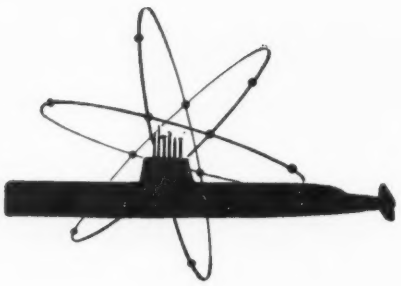
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For the FIRST time
NUCLEAR
POWER
is used for
PROPULSION





National Forge made many contributions to the "Nautilus." Among them were these two propulsion Shafts supplied to the Electric Boat Division of General Dynamics Corporation, builders of the Navy's new "Nautilus."

● The U. S. S. "Nautilus" is expected to outmode all existing transportation power methods. We're proud of our share in equipping her — and we're proud of our long association with the United States Navy.

Over the years the Navy has come to rely on National Forge facilities: the skill and abilities of the metallurgists, heat-treat experts, and skilled machinists to turn out forgings to their exact specifications.

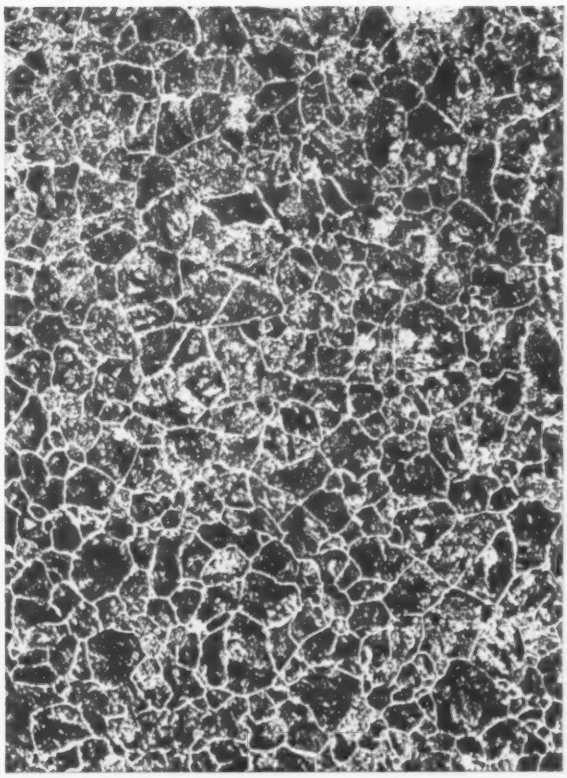
When next you need forgings, why not have them
NATIONAL-FORGED?

STEEL MAKERS ☆ FORGESMITHS
HEAT TREATERS ☆ MACHINISTS

National Forge AND ORDNANCE COMPANY
Irvine, Warren County, Pennsylvania

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Meet two of the reasons why TIMKEN® forging steels give you uniform, high-quality forgings

THE man on the left helps assure you of uniform composition in every Timken® steel forging bar. With this spectrometer, he can tell the exact composition of a melt in just 40 seconds. Results are flashed back to the furnace so the melter can maintain constant control of the heat analysis up to the instant of pouring.

The photomicrograph at right shows the uniform grain size of the Timken forging steels. Uniform grain size after heat treatment is assured by spectrometric or microscopic examination of every heat. The result—you can be sure that forgings made from Timken forging steels have uniformly high ductility and resistance to impact.

But that's only part of the story. You can hold rejects to a minimum because we condition the steel to fit your particular forging requirements. And you save steel because the good dimensional tolerances of Timken forging steels produce uniform weight multiples with a minimum of steel lost in flashings. You even have fewer furnace adjustments because Timken forging steels respond uniformly to heat treatment.

For help in improving the quality of your forgings and cutting production costs, write: The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable address: "TIMROSCO".

YEARS AHEAD—THROUGH EXPERIENCE AND RESEARCH



SPECIALISTS IN FINE ALLOY STEELS, GRAPHITIC TOOL STEELS AND SEAMLESS TUBING

Here's Good News for

U·S·S Free-Machining MX

is now available in OPEN HEARTH as well as BESSEMER

screw machine operators

The fact has been amply demonstrated that you can produce more parts per hour, that you can prolong tool life, minimize rejections, readily hold to tolerances and obtain better part finish by using MX screw stock.

In the past three years, the hundreds of shops that have put this faster-cutting bar stock into production have proved that MX will reduce the cost of *any* part by out-performing ordinary screw stock.

Such cost savings have averaged between 10 and 15%, sometimes ran as high as 40%. Today, you can confidently count on still bigger savings by using this steel.

And make a note of this. Now MX is also being produced in our Open Hearths to give screw machine operators a freer-cutting steel of the C-12XX type. This steel, especially controlled to improve cold-drawing characteristics, assures users of a fast-cutting bar stock not only of *excellent* surface quality but one that performs exceptionally well when finish-machined parts must be subjected to crimping or other deforming operations.

U·S·S Free-Machining MX—either Open Hearth or Bessemer—is available in all the popular bar sections and sizes. You can obtain it in cold-finished form from your regular supplier as "MX" or under his own identifying trade name. In hot rolled form, MX is available direct through our nearest district sales office.

USS

UNITED STATES STEEL CORPORATION, PITTSBURGH • AMERICAN STEEL & WIRE DIVISION, CLEVELAND
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO • TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA.
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UNITED STATES STEEL EXPORT COMPANY, NEW YORK

UNITED STATES STEEL



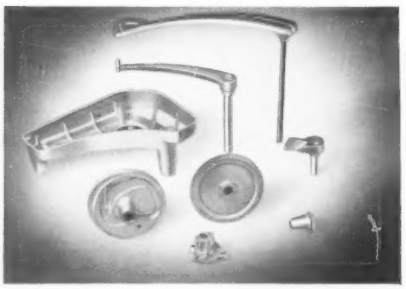
Here's Why....

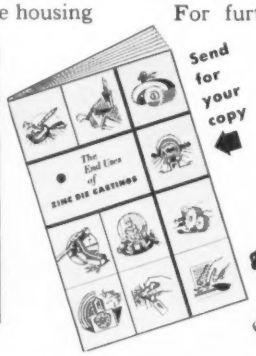
The engineers of Webster-Chicago have one aim in their industrial lives—to provide high fidelity sound reproduction at a price which will assure wide market appeal for every instrument in the Webcor line. To achieve this objective in their three-speed HF phonographs, the eight odd-shaped ZINC Die Cast components shown below are employed in several models. Of these, the above tone arm-rest housing best illustrates the physical and economic advantages gained.

Metal Saving—Since the cost of any product is influenced by the amount of material consumed, it should be noted that the above housing (as shown from the underside) has been ingeniously cored—*in the casting operation*—to eliminate all unnecessary metal, and no metal need be removed and wasted in secondary operations. This metal saving is accomplished with no sacrifice of strength since cross ribs are judiciously located at points of stress.

Labor Saving—The housing and the other ZINC Die Castings have made possible a compact phonograph mechanism with an absolute minimum number of parts. When such complexity of shape can be achieved, one part can be made to serve in place of several. This, together with the accurately located cast bosses, makes for trouble-free assembly at the lowest possible cost. A further labor saving results from the smooth as-cast surfaces of the parts which easily receive and hold handsome, durable coatings.

For further examples of successful product engineering with ZINC Die Castings ask us—or any die casting company—for a copy of "The End Uses of Zinc Die Castings."





The New Jersey Zinc Company
160 Front St., New York 38, N. Y.



ZINC
FOR DIE CASTING ALLOYS

The Research was done, the Alloys were developed, and most Die Castings are based on
HORSE HEAD SPECIAL (99.99 + % Uniform Quality) ZINC

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...and REX is the original high speed steel by which all others are judged

Great works of art clearly show the unique skills of their maker. Even the most careful copy can never truly duplicate the original.

Crucible REX® High Speed Steels are *originals*, too. Ever since 1900, when the Country's leading tool steel specialists combined their knowledge and formed Crucible, we have lavished on tool steel making all the skill and care that goes into any work of art.

That's why REX is the standard of comparison wherever high speed steels are used. But see for yourself. Put REX to work in your shop . . . check its hardenability, response to heat treatment, general quality and fine tool performance. We feel sure that, like thousands of others, you'll come back for more.



CRUCIBLE first name in special purpose steels

54 years of Fine steelmaking **TOOL STEELS**

CRUCIBLE STEEL COMPANY OF AMERICA · TOOL STEEL SALES · SYRACUSE, N. Y.

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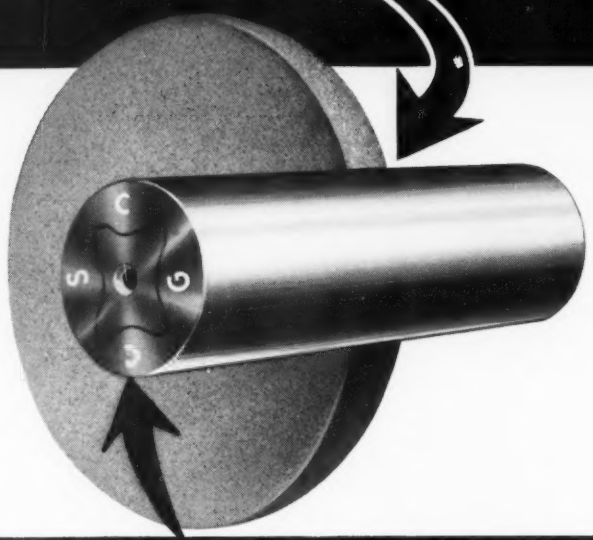
An exclusive GRINDING PROCESS...

makes

CUMBERLAND STEEL BARS

concentric, straight,

smooth & *really* accurate



BE SURE OF THIS MARK ON THE END OF YOUR SHAFTS

CUMBERLAND GROUND BARS FOR ALL TYPES OF MACHINES

They are carefully ground to our standard manufacturing tolerance, plus nothing to minus .002" on diameters 1-1/8" to 2-7/16" inclusive . . . plus nothing to minus .003" on diameters 2-1/2" to 8" inclusive. Closer tolerance can be furnished, if desired. And, remember, Cumberland Steel Bars are the end result of 109 years' experience,—and every bar is *carefully tested* before shipment. The list of Cumberland's customers reads like the "Blue Book" of Industry. Ask for further information.

MANUFACTURED IN THREE SPECIFICATIONS

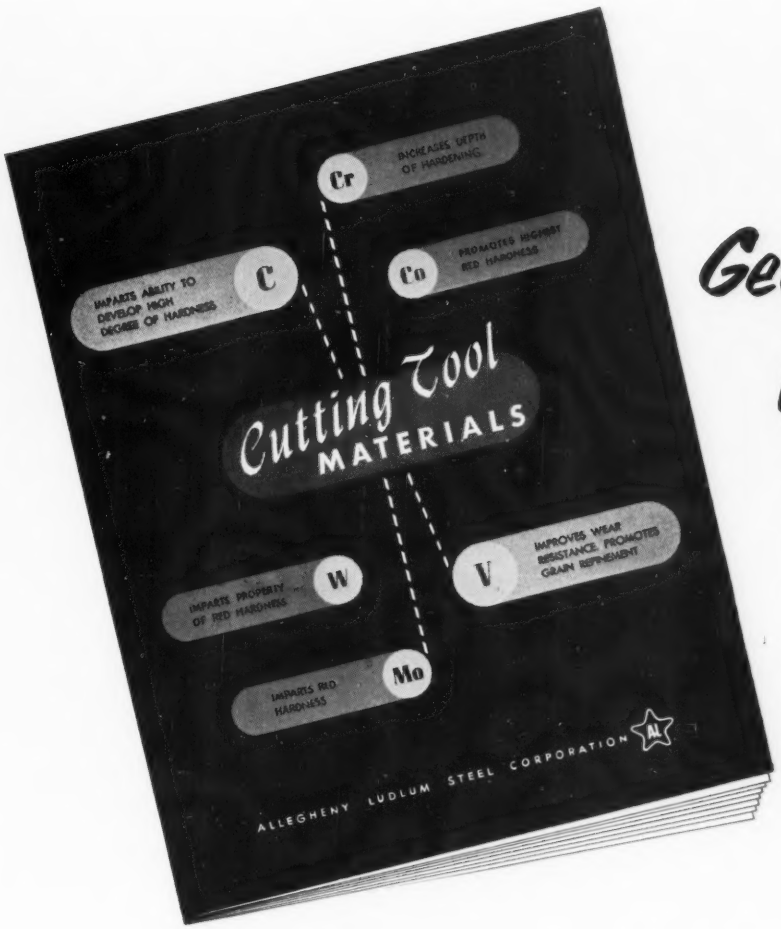
Cumberland Brand—AISI C-1020/C-1025, Elastic Limit 30,000# Min.
Potomac Brand—AISI C-1040, Elastic Limit 45,000# Min.
Cumsco Brand—AISI C-1141, Elastic Limit 57,000# Min.

CUMBERLAND STEEL COMPANY

CUMBERLAND, MARYLAND, U.S.A.

ESTABLISHED 1845 INCORPORATED 1892

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Get your copy...

WRITE FOR IT TODAY!

LOOK in this BOOKLET

when you're *puzzled about Tool Materials!*

A-L OFFERS YOU
Complete Service for Modern Tooling

By "complete" is meant that Allegheny Ludlum produces the full range of modern cutting tool materials, hence is in position to know and recommend the type best suited for any stated purpose. Unbiased content makes the 8½" x 11" booklet, shown, all the more valuable. Specify its title, "Cutting Tool Materials."

ADDRESS DEPT. M-57

You should have a personal copy of this 36-page booklet close at hand, if you are continually running into new cutting problems. Use it as a guide to quick answers to scores of possible questions such as:

"Should we use *Carbide* on this job? What grade?" . . . or, "How about tooling up with *Cast Alloy* for that other run?" . . . or, "Can we cut this extra-tough stock fast enough with our usual grade of *High Speed Steel?*"

This booklet in no way replaces, but does supplement, what you can learn by practical experience or what you can gain by calling in an A-L tool engineer. In compact form and quite impartially, the booklet presents the basic facts that enable you to speedily compare the suitability of various tool materials for specific uses. *Send today for your free copy.* There is no obligation involved.

● *Allegheny Ludlum Steel Corporation, Henry W. Oliver Bldg., Pittsburgh 22, Pa.*

For complete **MODERN** Tooling, call

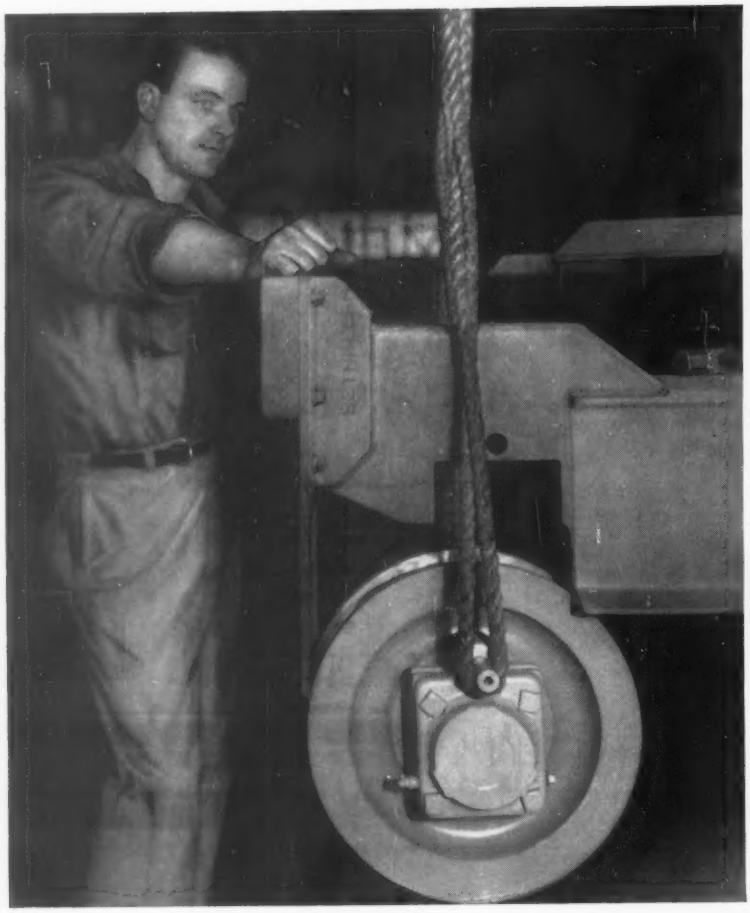
Allegheny Ludlum

W&D 3703

AL
FINE TOOL STEELS SINCE 1854

For more information on products advertised, use Inquiry Card, page 243

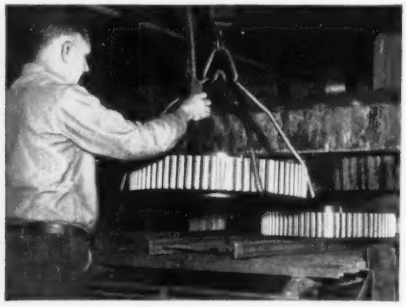
The Blanks with Extra Strength... yet not a pound of surplus weight





▲ Easy to machine, forged-and-rolled blanks are ideal for the making of sheave wheels.

◀ Crane-track wheels are made from Bethlehem forged-and-rolled blanks by Shepard Niles Crane & Hoist Corporation, Montour Falls, N. Y. The customer cites the longer life of these wheels, and their strength and shock-resistance — qualities valuable in the heavy-duty machines built by the company.



▲ Another common end use: gears.

On this page are shown several uses of Bethlehem forged-and-rolled circular blanks. All these applications require high strength. Yet in each case it is desirable to eliminate needless weight. That's why Bethlehem blanks are the logical choice, for they *do* have high strength without so much as a pound of surplus weight.

Reason: the blanks are made by a process that combines the steps of forging and rolling in a single operation, thereby assuring the density of forged metal and the good grain flow and structure of a rolled product. Result: unusual stress-resistance. Because of this characteristic, customers have frequently found it possible to use thinner sections than they formerly specified.

End products made from these blanks include spur, bevel, and herringbone gears, crane-track wheels, sheave wheels, clutch drums, flywheels, turbine rotors, tire molds, and similar parts. The blanks are available in a wide choice of sections, and they can be furnished untreated or heat-treated, as you prefer. Sizes range from 10 to 42 in. OD.

Why not investigate? It could be the first step toward a stronger product . . . and important shop economies we'll be glad to tell you about.



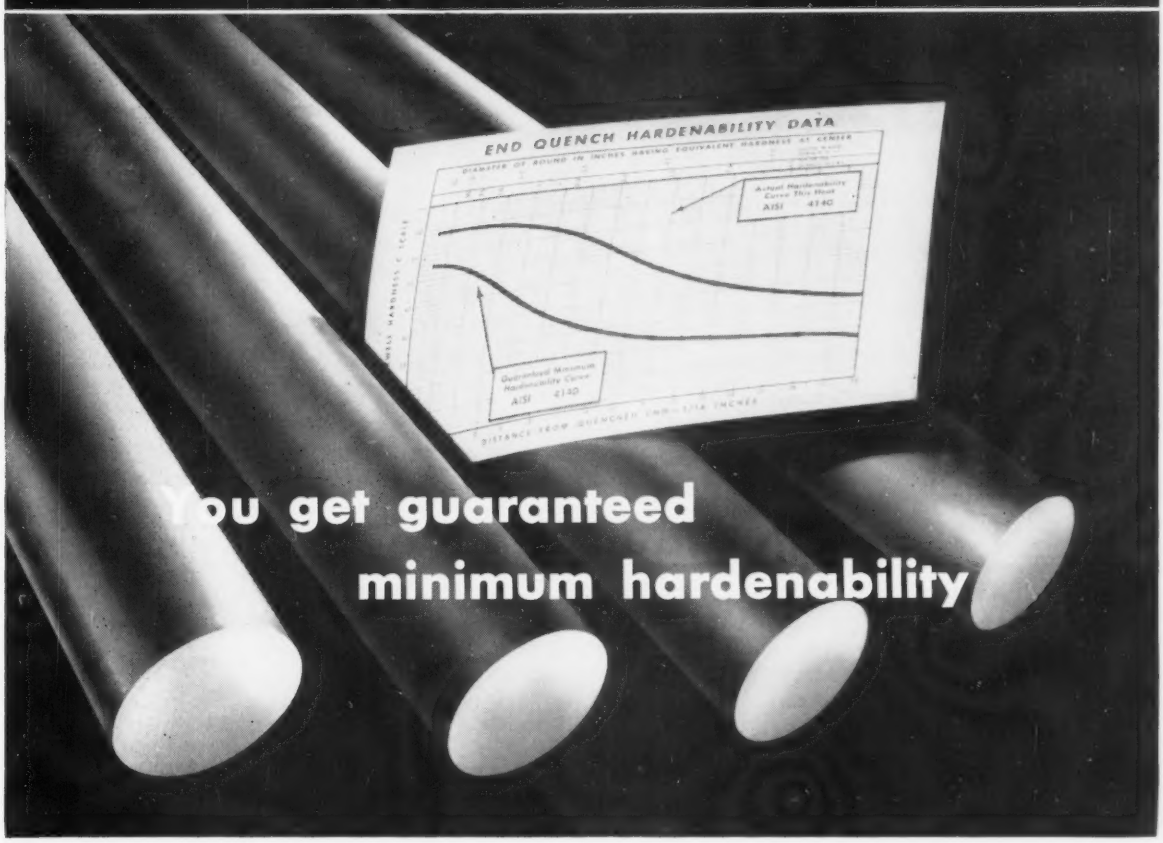
BETHLEHEM
Forged-and-Rolled
CIRCULAR FORGINGS

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation
Export Distributor: Bethlehem Steel Export Corporation

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WHY IT PAYS TO BUY ALLOY STEELS FROM US



• You *know* what you're getting when you buy alloy steels from U. S. Steel Supply. For with each lot you purchase, we furnish a personalized data card. This card charts the guaranteed minimum hardenability and gives analysis information and recommended tempering and working temperatures. You are thus assured of getting in full measure the tensile strength, fatigue resistance, ductility and toughness that your design requires. We can assure maximum machinability too, for we adhere to unusually strict metallurgical standards in the purchase of all our alloys.

Have you ever seriously considered how alloy steels might contribute to your production of a better product at a cost that might be even lower than at present? If not, it will pay you to call U. S. Steel Supply. One of our salesmen will gladly study your specific problems and, if alloy steel will do a better job for you, he will recommend the best alloy and see that you get it promptly.

Call us for: USS Carilloy alloy steels—hot rolled rounds, cold finished rounds, squares, hexagons, "FC" (Free-Cutting) rounds; USS Carilloy Aircraft Quality hot rolled rounds and flats and cold finished rounds, squares, hexagons, flats.

TRIPLE SECURITY

What you want
When you want it
At the **right price**

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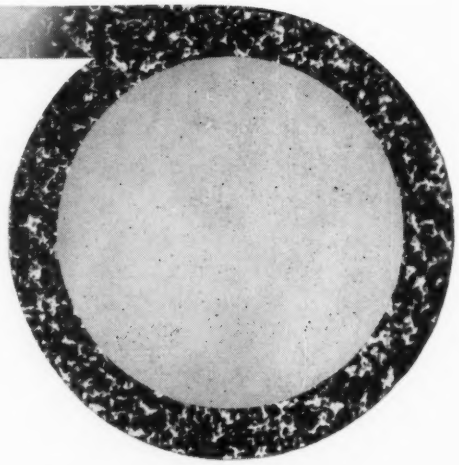
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Coast to Coast

USS STEEL
UNITED STATES STEEL

UNITED STATES STEEL

Are your Alloy Steel Bars in the PROFIT AREA for your MACHINE TOOLS?

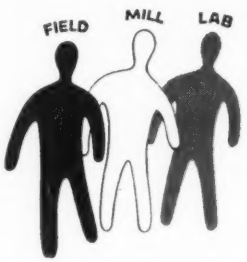


It's the outer rim of a Republic carbon-corrected alloy steel bar that helps you make a profit. In the ordinary heat-treated bar this is a "decarb" area that usually must be removed before parts can be made from stock. In a Republic bar, the carbon has been restored after heat treating . . . right out to the edge.

You don't machine away good metal into chips and shavings. And that can make a substantial difference in your profits.

Republic's 3-Dimension metallurgical service will be glad to show you how you can get in on such savings as these. It works with your metallurgists and production people to adapt cold-drawn carbon-corrected alloy steel bars to your product. The combined extensive experience and abilities of Republic Mill, Field and Laboratory metallurgists are added to the knowledge and skills of your engineers.

The result often means better products at reduced costs. Get in touch with your Republic Steel salesman. He can arrange for a Republic metallurgist to call at your convenience.



3-Dimension Metallurgical Service

combines the extensive experience and co-ordinated abilities of Republic's *Field, Mill* and *Laboratory* Metallurgists with the knowledge and skills of your own engineers. It has helped guide users of Alloy Steels in countless industries to the correct steel and its most efficient usage, IT CAN DO THE SAME FOR YOU.

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Union Drawn Steel Division • Massillon, Ohio
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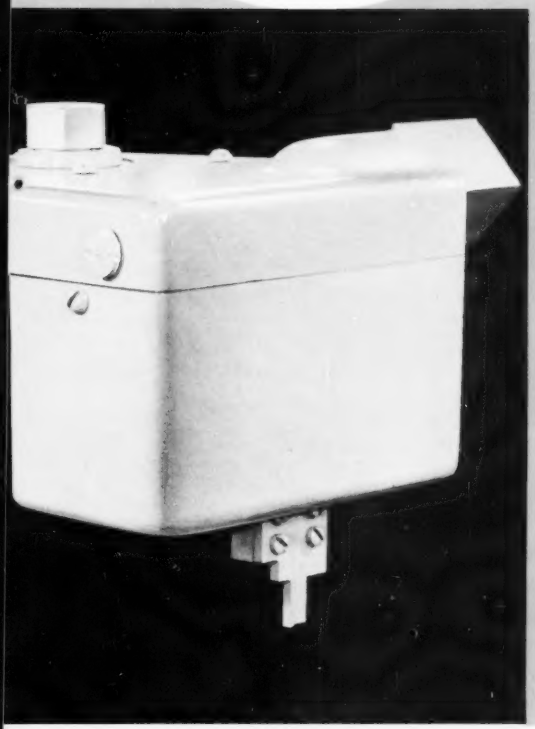
REPUBLIC COLD DRAWN ALLOY STEEL BARS

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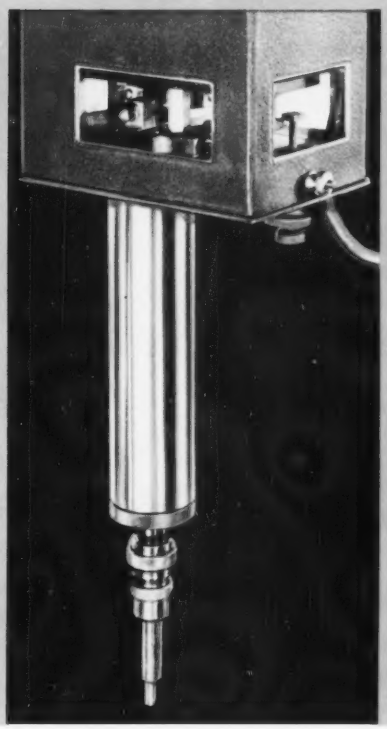
3 Heads are Better Than One

✔ CHECK THE *THREE* TRACER CONTROLLED TURNING METHODS OFFERED BY MONARCH—

PIONEER AND LEADER IN THE TRACER TURNING FIELD



The Motor-Trace . . . for fast, repetitive shaft turning at its economical best—for step boring and step facing.



Monarch-Keller Controls . . . recommended for more intricate shaped molds and dies, for form rolls and other parts.



The Air-Gage Tracer . . . for turning multiple diameter shafts and turning, boring and facing contours.

Why Tracer Controls?

Tracer controlled automatic single-point turning slashes setup time and machining time; cuts tooling costs; reduces tool-crib inventories; in many cases, materially reduces or even eliminates subsequent grinding operations; delivers a high degree of accuracy; by reducing the chance for human error, practically dispenses with work spoilage. In many fewer words, as the job examples on the next three pages prove, it gives you PEAK PRODUCTION AT LOWER COST—for long runs and short ones.

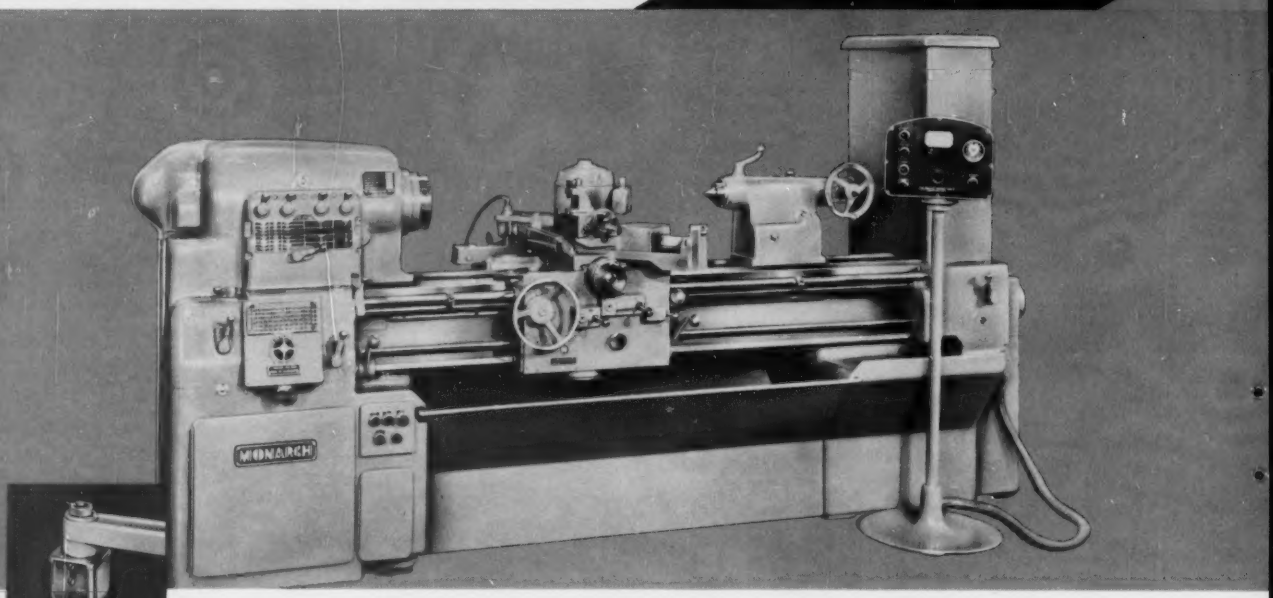
Why Monarch Tracer Controls?

They're our babies! We pioneered Monarch-Keller Controlled Turning 24 years ago—and have been pioneering, proving, producing, refining and innovating ever since. You choose from our 3 types the one suited for your job, and at least one type is available for every Monarch lathe. They use all duplicating methods—round or flat templates, micrometer heads or gage blocks. And they've been used on more lathes, for a greater variety of operations, than any other types of tracer controls. Go Monarch—trace it and save!

IMPROVE QUALITY **CUT COSTS** **BOOST OUTPUT**

(See Examples on Next 3 Pages)

TRACE IT AND SAVE with the Monarch AIR-GAGE TRACER



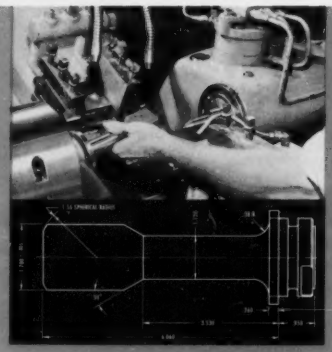
The Monarch Series 61 Lathe with Air-Gage Tracer. Hydraulically operated, controlled on air-gaging principle, this is the most accurate duplicating device on the market. With tracer stylus operating on a pressure of only 5-6 ozs., change in template contour converts to corresponding tool position in thousandths of a second and movement of slide to control point repeats itself within a limit of .0001". It can be applied as factory equipment on all sizes of 10" to 32" machines, the Mona-Matic and Right Angle Lathes—exclusive swiveling type optional. With the Auto Cycle Unit, any Monarch Lathe equipped with Air-Gage Tracer Controls becomes a fully-automatic, high-production unit.

WHAT IT DOES

1. Imparts a smooth, stepless finish because of the continuous, single tool cut.
2. Provides automatic sizing.
3. Eliminates the necessity for repetitive measurements.
4. Generally reduces by half the amount of stock left for grinding.
5. Often eliminates hand polishing or grinding because of the fine finish imparted to the work.
6. Produces more accurate work than any other duplicating device.
7. Eliminates need for expensive forming tools and cost of multiple tool setups.
8. Allows complete setup change in fifteen to twenty minutes; tool change in one minute or less.
9. Permits the machining of practically any combination of diameters, tapers, bevels, forms, grooves, undercuts, shoulders, necks, radii and chamfers in a single continuous cut.
10. Reduces the chance for human error, thereby materially reducing the amount of spoiled work.
11. On many classes of work, saves time and money and provides better finish and accuracy than machining by multiple tool methods.

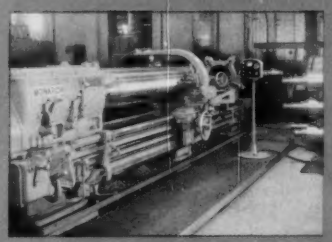
SAVE SETUP TIME

Part—fork 6" x 2" OD. **Material**—4130 chrome-moly forging heat-treated to hardness of 125,000—145,000 psi before machining. **Operation**—finish turn. **Machine**—Monarch Mona-Matic with Air-Gage Tracer. **Comment**—job previously performed on 3 machines—turret lathe, engine lathe and grinder. Total time—50 min. Single Mona-Matic completely turns in 5 min.—*has reduced setup time from 3 hrs. to less than 20 min.* Try *this* on small lots!



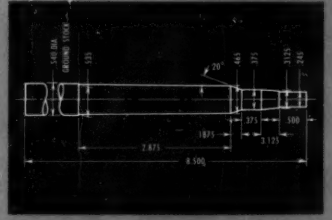
SAVE MACHINING TIME

Part—printing press roll. **Material**—SAE 1045 forging. **Operation**—turn complete. **Limits** — bearing shoulder spacing + .001" and — .000". **Machine**—Monarch 25" x 144" Model N Engine Lathe with Air-Gage Tracer and Auto Cycle Unit. **Comment** — former turning time was 7⅓ hrs. per piece. Monarch turning time is only 1⅓ hrs. per piece. *Five times the production!*

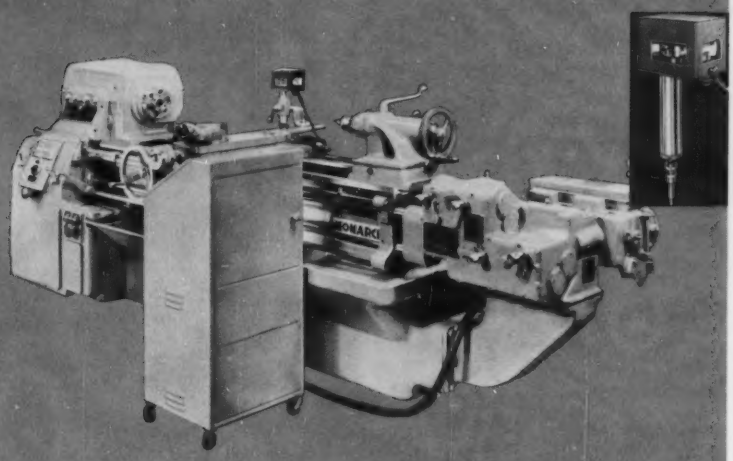


SAVE ALL THE WAY!

Part — reamer blank. **Material** — high speed steel. **Operations Performed**—turn complete excepting .540" diameter. **Maximum Depth of Cut**—7/64". **Limits** — ± .001". **Total Machining Time**—3 minutes 36 seconds. **Machine**—10" Precision Manufacturing Lathe. **Comment**—three cuts are required so as not to spring work. The above production was secured immediately by an operator who had never seen an Air-Gage Tracer equipped machine. *Customer estimates that savings will pay for machine in less than one year.*



TRACE IT AND SAVE with MONARCH-KELLER CONTROLS



Monarch-Keller Form Turning Machines, pioneer of all tracer controlled lathes, have been delivering results for almost 25 years. Magnetic clutch operated, electric tracer controlled through the medium of a push button control stand. Clutch energization occurs in 1/125 second—practically instantaneous response to template contour change, which is reproduced on work to accuracies of ± .001″ or less. Monarch-Keller Controls can be applied to all Monarch Lathes 16″ swing and up—are used on Shapemaster Engraver and Heavy Duty Roll Turners.

WHAT IT DOES

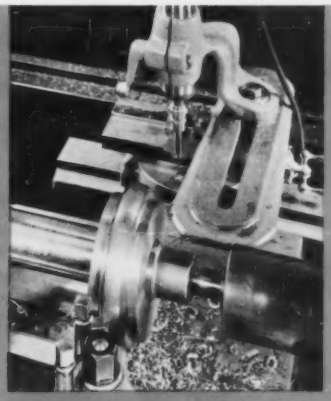
1. With its unique universal stylus movement, very slight pressure creates feed toward, parallel to and away from center line of machine. Substantial savings are thus effected in turning, boring and facing irregular contours, intricately shaped molds and dies, form rolls and other intricately shaped parts.
2. Affords time savings over conventional methods of from 80 to 85% in many cases.
3. Reduces greatly the stock left for grinding.
4. Ease and speed of setup are equally advantageous for both long production runs and small lot work.
5. Affords tooling savings especially pronounced in the elimination of form tools in form roll turning.
6. Duplicating template contours, human error is eliminated and work spoilage greatly reduced. In turning form rolls, there is no need for pairing rolls.
7. Does not limit length or diameter capacity, and has power to take heavy cuts up to the capacity of the lathe used.
8. Controls can be engaged and disengaged at the flick of a switch, making machine available for use under manual control.
9. Electrical control stand can be located to operator's convenience.
10. Controls can be factory-applied to all Monarch Lathes 16″ swing up, or such machines factory-prepared, at slight additional cost, to receive them later in field.

SAVE SETUP TIME

Form Roll for automobile body decorative strips. This job typifies a class of turning that can be handled by Keller controls at savings which cannot be approached by any other method.

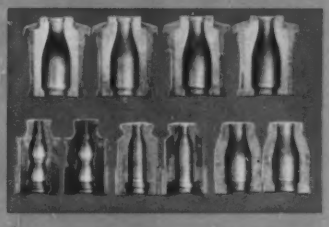
Material is air hardened steel. A carbide cutting tool is used and each roll is both rough and finish turned during the same setup. Maximum depth of cut is 1/32″.

Average turning time for a pair of rolls is slightly over 70 minutes. *Setup time is only 4 minutes per roll,* giving great economy when shifting over from one operation to another.



SAVE MACHINING TIME

Bottle moulds bored on the Monarch-Keller Lathe. Time required to rough and finish each set of moulds shown here is from 30 to 40 minutes. Usually, on a Monarch-Keller Lathe, the more difficult the nature of the work, the more time is actually saved by doing it with the Monarch-Keller method.



SAVE ALL THE WAY!

Goblet mould set. Photograph shows a goblet mould set made on a 16″ Monarch-Keller Lathe. Total machining time required is 11 hours, 39 minutes. Prior to the use of this machine, 44 hours were required for the same operations.

On this basis of saving, the Monarch-Keller Form Turning Machine would *pay for itself in less than one year.*

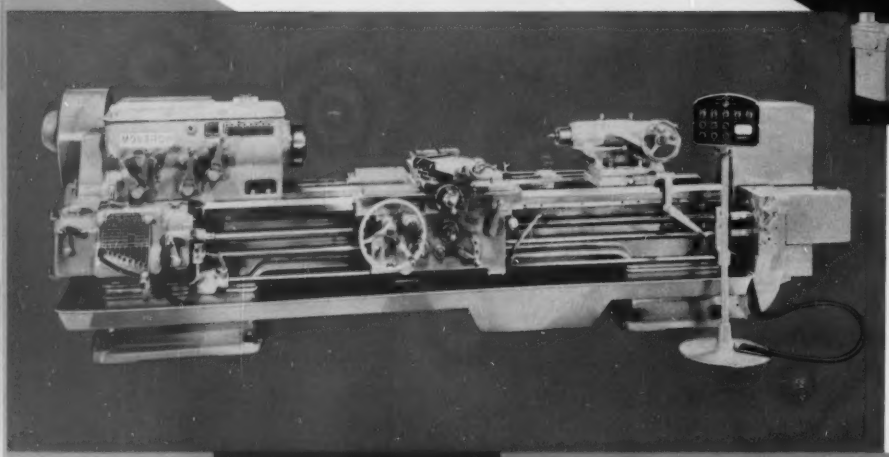


Monarch TURNING MACHINES

FOR A GOOD TURN FASTER • TURN TO MONARCH

FOR MORE COMPLETE MONARCH TRACER CONTROL INFORMATION — SEND COUPON ON NEXT PAGE

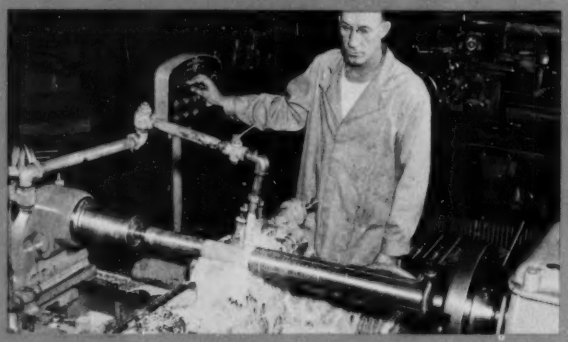
TRACE IT AND SAVE with MONARCH MOTOR-TRACE



Monarch 20" Heavy Duty Lathe with Motor-Trace. Here's fast, repetitive shaft turning at its economical best. With this electric motor operated, electric tracer controlled duplicating attachment, Monarch Engine Lathes become automatic cycle machines producing parts economically in quantities of 2 or 3 pieces and up. That's possible only because of the exclusive micrometer head method of tracer actuation. Applicable to 16" and 20" Monarch Lathes without reduction of normal swing capacity.

WHAT IT DOES

1. Makes it possible to convert a Monarch engine lathe from manual operation to automatic operation in less than one-half minute.
2. Saves time on lots as small as 2 or 3 pieces because total setup never requires more than 15 minutes.
3. On straight, multiple diameter work, provides accurate size control without tracer being in constant contact with a template. This allows use of micrometer heads, gage blocks or a simplified form of flat template.
4. Uses every second of the cycle to full advantage because tool rapid traverses at all times excepting when under actual cut.
5. Permits the pre-selection and automatic use of the correct feed for maximum cutting efficiency on each diameter. As many as five different feeds may be used on the same work piece.
6. Provides complete electric control from the point most convenient to the operator.



Save—with output like this. Part—shaft. Material—AISI 3140. Length—54⅜". Largest Diameter—4.125". Operations performed—turn complete. Number of feeds used on both ends—4. Maximum depth of cut—⅜". Cutting tool—carbide. Limits—± .002". Total machining time per piece—8⅓ minutes. Total handling time per piece—3¼ minutes.

TRACE IT AND SAVE WITH MONARCH

Toolmaker's Lathes—10" to 20" • Engine Lathes—10" to 32" • The Mona-Matic *for high production metal turning* • The Speedi-Matic *a fast, precision hand screw machine* • The Monarch Motor-Trace • The Monarch-Keller Turning Machine • The Monarch Air-Gage Tracer • The Monarch Roll Turning Lathes • The Monarch 60" Right Angle Lathe • The Shapemaster Engraver • Special Turning Machines

THE MONARCH MACHINE TOOL COMPANY
SIDNEY, OHIO

See preceding 3 pages for the story —send the coupon for full information

THE MONARCH MACHINE TOOL COMPANY, Sidney, Ohio

Gentlemen: Please send me without obligation the booklet(s) specified below:

___Air-Gage Tracer Booklet #2607.
___Monarch-Keller Booklet #2401.
___Motor-Trace Booklet #2302.
___Please have a Monarch Sales Engineer call with information.

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...delivers high production-low cost carbide planing!

Here's high production — low cost carbide planing at the Beloit Iron Works, Beloit, Wis. This GRAY OPENSIDE PLANER CUB is running 300' per minute, day in — day out, carbide planing packing strip holders for suction rolls of paper making machinery.

BETTER BE QUICK!

or the job will be finished before you turn the page!

Planer jobs don't grow old on a GRAY!

Ever see a planer running wide open, day after day at 300' per minute? That's the pace of a new GRAY — the pace that makes your old planer look really old.

Why should you be interested?

Because a GRAY CUB is not only an economical initial investment — it also insures substantial savings in time and money thru its high speed, accurate production ability.

Write today—get the story on GRAY

HIGH LOW COST PRODUCTION

The G.A. **GRAY** *Company*

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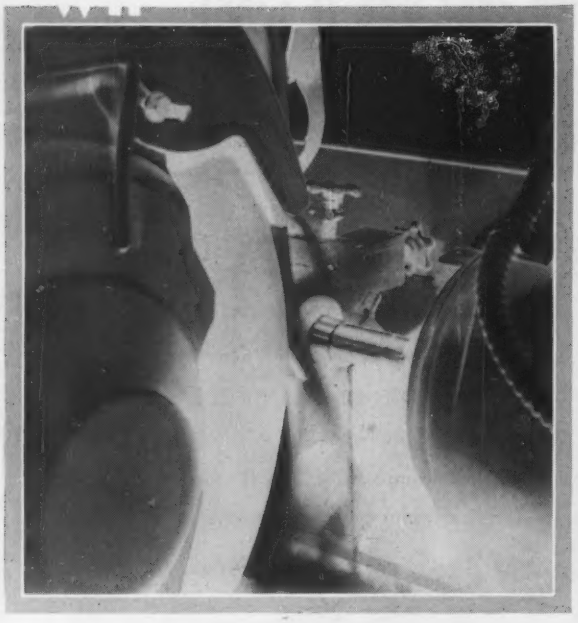
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planer type milling machines
horizontal boring machines

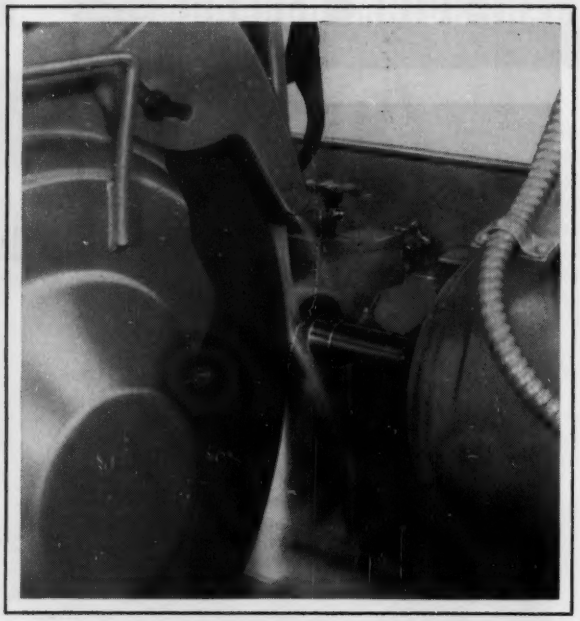
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A remarkable achievement in precision manufacturing and quality control . . . .

NOW!

Cincinnati Grinding Wheels offer

Positive Duplication

PD

THE DEVELOPMENT of the new CINCINNATI (PD) Manufacturing Process is one of the most important improvements in grinding wheels in years—a development that will save you money and increase your production.

It means a brighter working picture for you because now, through the CINCINNATI (PD) Manufacturing Process you can be *positive* that *every* CINCINNATI (PD) WHEEL you order for a job will be produced exactly to the CINCINNATI grading specified.

Just as a negative guarantees exact duplication of a photograph, the CINCINNATI (PD) *Manufacturing Process assures a Positive Duplication of the original wheel every time you reorder.*

The problem of duplication has been a major concern of Cincinnati Milling throughout its 30 years of practical experience in using grinding wheels, and in supplying industry with precision grinding machines equipped with grinding wheels and ready for production operation. Cincinnati Milling found that once the right grinding wheel had been specified for a particular job, sometimes it was difficult to secure additional wheels of identical grading that would duplicate the performance of the original wheel.

The need for Positive Duplication in the manufacture of grinding wheels is of utmost importance not only to Cincinnati Milling, but to every user of grinding wheels.

Positive Duplication (PD) is the result of extensive manufacturing research which revealed that *several steps* in the production of grinding wheels generally considered as unimportant, were quite to the contrary, *extremely important.* As one step toward (PD) WHEELS, Cincinnati Milling constructed the world's most modern grinding wheel plant. Some of the equipment installed has never before been used by the industry in the manufacture of grinding wheels.



Then, to make (PD) WHEELS an actuality, Cincinnati Milling developed new standards of manufacture with 36 quality control steps. From the weighing of the grain and bonding material, through molding, drying, firing, finishing, to final inspection, every operation is carried out with the same exactness as in building a precision machine tool.

You're assured a Positive Duplication of the original wheel *every* time you reorder. "On grade" with a CINCINNATI (PD) WHEEL means all future (PD) WHEELS will act and grind exactly alike. For you, this means *no more production interruptions* which cut output and increase your costs.

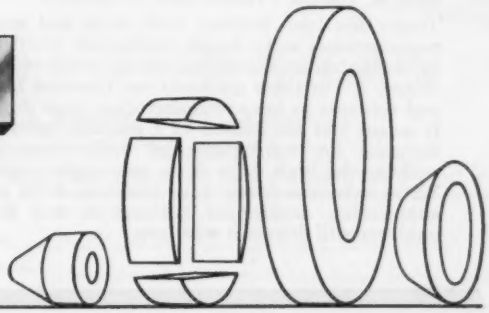


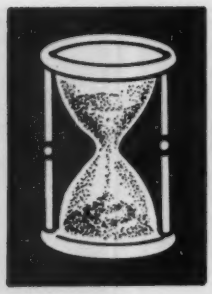
Let us prove to you how CINCINNATI (PD) WHEELS will make money for you. Just contact us and we'll send one of our representatives—men who know grinding and grinding machines as well as grinding wheels. Write, wire or 'phone Sales Manager, Cincinnati Milling Products Division, The Cincinnati Milling Machine Co., Cincinnati 9, Ohio.

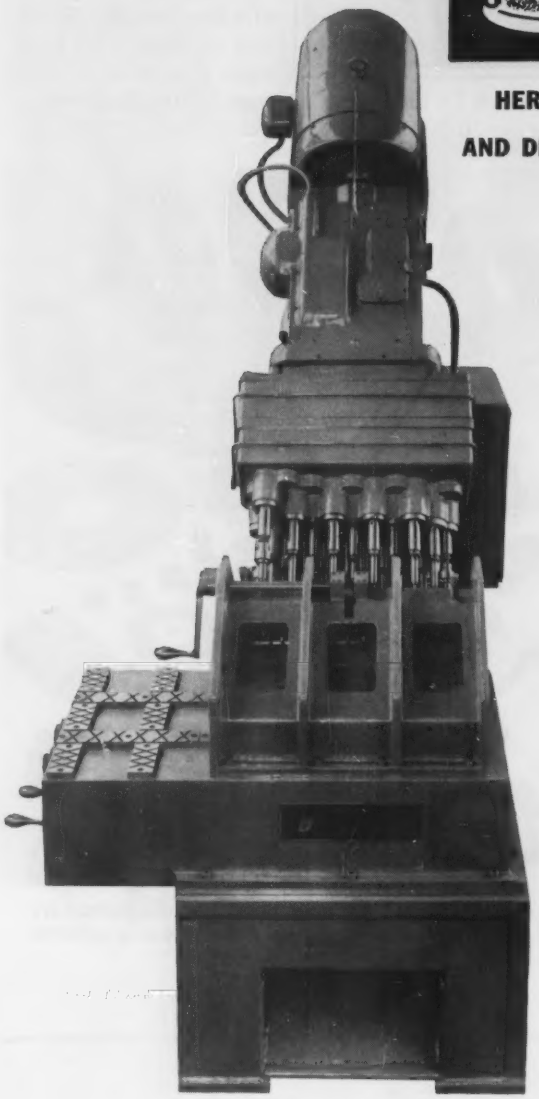


CINCINNATI (PD) PRECISION AND SNAGGING WHEELS are available in vitrified and resinoid bonds in a complete variety of popular sizes and shapes.

CINCINNATI
Grinding Wheels
THE CINCINNATI MILLING MACHINE CO.
Cincinnati 9, Ohio



WHEN TIME COUNTS  COUNT ON TURNER



HERE'S HOW TURNER DESIGNED, BUILT, TRIED OUT, AND DELIVERED 4 DRILLING MACHINES IN 9 WEEKS' TIME FOR A PILOT MOTOR-BLOCK LINE

Problem: How to get four 22-spindle drilling machines onto the drawing boards . . . into production . . . tried out and delivered, in less than half the normal time required.

Solution: Turn to Turner. That's what a large automobile company did when a pilot motor-block line was needed in a hurry.

Result: Four 22-spindle machines were designed, produced, tried out and delivered in 9 weeks although the normal delivery schedule for this job was between 5 and 6 months.

Question: How can Turner do this? The answer, of course, is that Turner Bros., Inc. combines competent plant management and practical engineering methods with all of the skill and experience of trained personnel. 40% of this trained personnel have been with the company for a period of at least ten years. That's one of the reasons why the Turner organization operates as a well organized, closely knit team of designers and engineers who are able to work to a tight schedule. For instance, when one of Turner's sales engineers encounters a problem out in the field, he employs a practical working knowledge based on experience to see that it is brought into the shop where skilled engineers and trained mechanics can solve it.

This efficient engineering service and unusually prompt delivery is all part of a day's work at Turner. They have the men, tools, equipment and skill to take care of emergency calls for machine tools. No order is too large . . . no customer is too small to receive prompt, individual attention. The next time you're in a tight delivery spot, why not call on Turner? You'll find that when time counts, you can count on Turner.

Got A Tough Production Problem?

Turner has been helping both large and small manufacturers solve tough production problems by designing and building special purpose machines. All of these machines use standard bases and columns to keep manufacturing costs down. It means you are assured of a machine specially designed for your particular application, yet without the high extra costs you might expect. Write today describing your problem. After our engineering department analyzes it, our field engineer will discuss it with you.

TURNER BROS. INC.
2625 HILTON ROAD
FERNDALE 20, MICHIGAN
DESIGNERS and BUILDERS of:
• SPECIAL MACHINES
• JIGS and FIXTURES



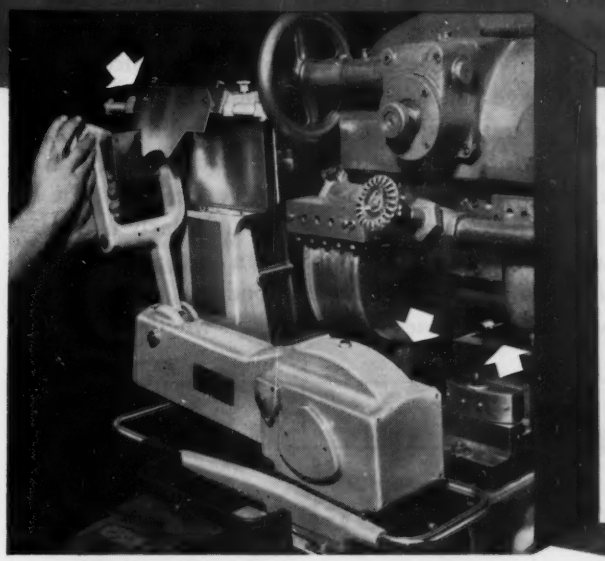
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NOW for the first time!

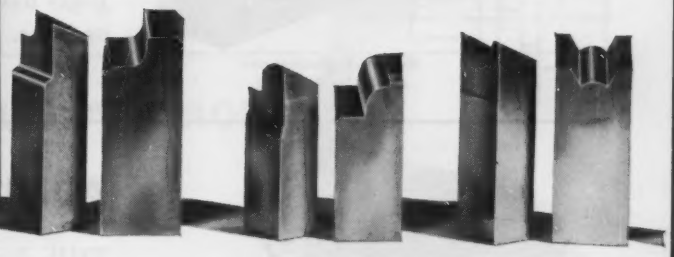
RELIEF GRIND FORMED CUTTING TOOLS

QUICKLY • EASILY • ECONOMICALLY without Lengthy Calculations

THE REVOLUTIONARY NEW PRATT & WHITNEY Relief Angle Compensating



Diaform WHEEL FORMING ATTACHMENT



Here is the most important advance in the making of formed cutting tools in nearly a century! This new model DIAFORM Wheel Forming Attachment is equipped with the unique Relief Angle Compensator that works from a simple, **true-to-form** template to provide complete, accurate compensation for all front and side relief and top rake angles normally required . . . even when cutting aluminum alloys, plastics, wood etc. Lengthy calculations, trial-and-error, projection drawings and distorted templates are eliminated; important savings in time and effort are realized.

Operation is simple. The template (prepared to the **exact** contours and dimensions of the finished product multiplied 5X or 10X) is mounted on the carrier. This assembly, which is equipped with graduated scales, is tilted to the included angle of both the front relief and the top rake; for side relief, the carrier is swiveled to the desired angle. The operator has now only to follow the template with the tracer bar using the guide knob, and the truing diamonds form the grinding wheel accurate to "tenths" and correctly compensated.

TAKE ADVANTAGE OF THIS NEW SCIENCE IN CUTTER RELIEF GRINDING . . . SEND NOW FOR COMPLETE INFORMATION — Just fill in and mail the attached coupon . . . or write on your Company letterhead.



PRATT & WHITNEY

DIVISION NILES-BEMENT-POND COMPANY

WEST HARTFORD 1, CONNECTICUT, U.S.A.

BRANCHES IN PRINCIPAL CITIES

SINCE 1860

First Choice for *Accuracy*

MACHINE TOOLS • CUTTING TOOLS • GAGES

PRATT & WHITNEY — Div. Niles-Bement-Pond Co.

12 Charter Oak Blvd., West Hartford 1, Conn.

Gentlemen: Please mail my free copy of Circular No. 574 that gives complete data on the new P&W Relief Angle Compensating DIAFORM.

NAME_____

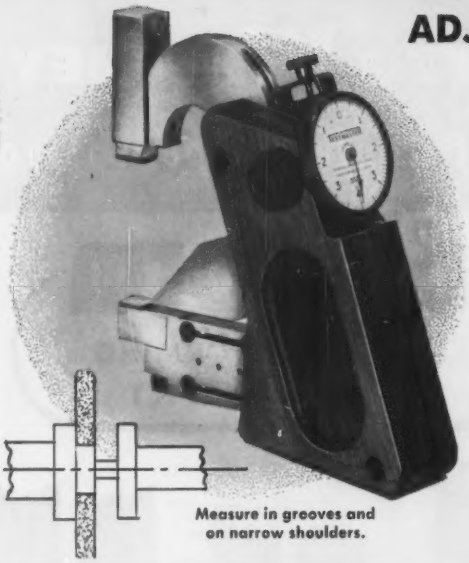
POSITION_____

COMPANY_____

CO. ADDRESS_____

CITY_____ ZONE_____ STATE_____

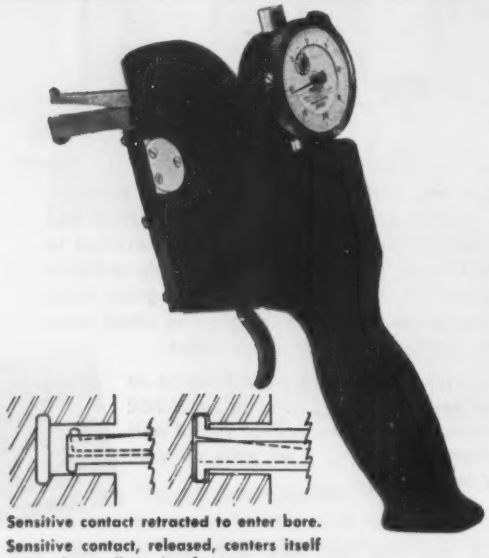
Two NEW gages get measurements IN THE GROOVE!



Measure in grooves and on narrow shoulders.

ADJUSTABLE INDICATING SNAP GAGES 1340 TYPE

THESE ADJUSTABLE SNAP GAGES show *actual* dimensional variations of .0001" because the gage rests on the "solid" upper anvil and the reading is not influenced by the weight of gage nor by the user's hand. The anvils are offset at front of gage and the upper anvil is readily adjustable. When it's locked at the desired position, minor adjustments are made by adjusting the Indicator Dial. The thin anvils and arms of these gages are particularly useful for measuring in grooves, slots, or between close shoulders. Inexpensive, adaptable and totally dependable, these new gages have a thousand uses in all shops — whether small or large.



Sensitive contact retracted to enter bore.
Sensitive contact, released, centers itself at maximum diameter of groove.

ADJUSTABLE I. D. GROOVE GAGE

THIS NEW GAGE IS ADJUSTABLE TO MEASURE the diameter of a wide range of internal grooves as used for sealing or retaining rings. Adjustable to measure grooves between .725" and 2.625" diameter, it enters bores with diameters down to .500". Contacts at the ends of the arms check grooves even at the bottom of blind holes. Because the fixed contact is on lower arm, neither the weight of the gage nor pressure from the operator's hand affects the reading. For the whole story on these NEW gages, write:

FEDERAL PRODUCTS CORPORATION
4119 EDDY ST., PROVIDENCE 1, R. I.

Ask **FEDERAL**

FOR ANYTHING IN MODERN GAGES...

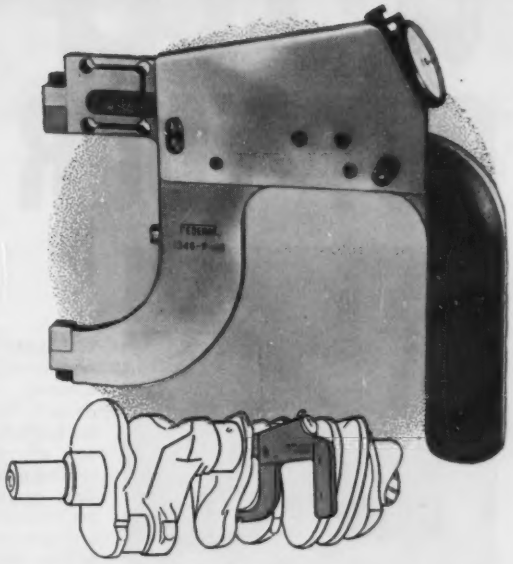
Dial Indicating, Air, Electric, or Electronic — for Inspecting, Measuring, Sorting, or Automatically Controlling Dimensions on Machines

TWO NEW GAGES

TRY 'EM FOR *SIZE* ON TOUGH MEASURING JOBS!

INDICATING CRANKSHAFT GAGE MODEL 1340 P-40

BUILT ESPECIALLY FOR CRANKSHAFT JOBS and similar work, this thin gage gets in between shoulders or close beside bearings and its flat anvils of Tungsten Carbide permit accurate measurements of such critical dimensions. Measurements are transferred from the sensitive anvil to the CONVENIENTLY PLACED INDICATOR through the integrated pantograph unit. Free of all friction, inertia and side play, this unit also counteracts the weight of the gage and operator's hand.



No matter what the position of the throws, Model 1340 P-40 easily measures bearing diameters in the narrow spaces between shoulders of a crankshaft.

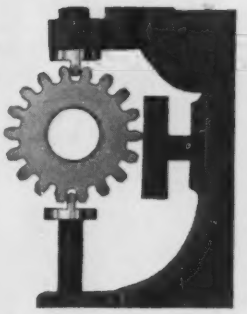
PITCH DIAMETER AND SPIRAL GEAR GAGE 202 SERIES

FOR USE IN STATISTICAL QUALITY CONTROL right at the machine as well as final inspection, these gages check pitch diameter of spur gears, helical gears, splines, and chain sprockets. Both upper and lower contacts are of Tungsten Carbide. The upper contact is adjustable for 1″ on all five regular sizes and swivels so it seats properly in relation to the lower anvil before being locked in position. The adjustable rear guide positions the gage on the gear, assuring gaging the proper spaces between gear teeth which may be either even or odd in number. For complete information on these new tools, write today to:

FEDERAL PRODUCTS CORPORATION
4119 EDDY ST., PROVIDENCE 1, R. I.



Gear centered properly by rear guide and cylindrical contacts.



Ask **FEDERAL**

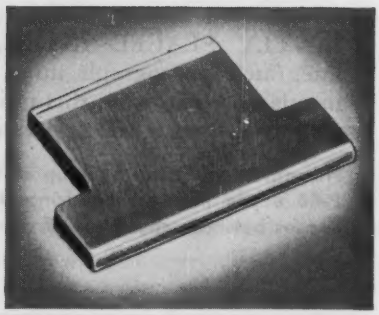
FOR ANYTHING IN MODERN GAGES...

Dial Indicating, Air, Electric, or Electronic — for Inspecting, Measuring, Sorting, or Automatically Controlling Dimensions on Machines

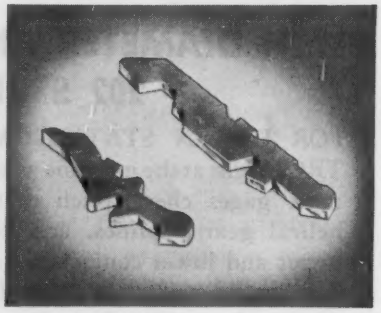
Why wait?
CUT YOUR COSTS NOW!

let the leading manufacturer of broaching equipment show you how to lower your break-even costs.

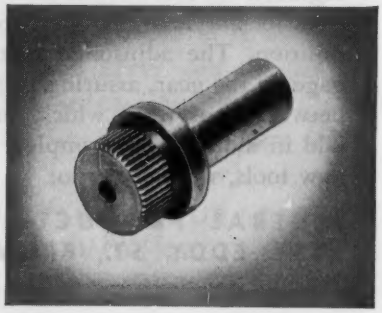
TEN TIMES FASTER than previous methods—broaching top and bottom radii on these automatic transmission reverse band anchors is helping one manufacturer lower the break-even costs. The design called for both edges to be rounded with a taper leading into one of the rounded edges. Besides increasing production by 10 times, the broached surfaces are more accurate, and costs are kept to a minimum. Thousands of these band anchors are being machined between broach sharpenings.



THIRTY TIMES FASTER than milling—broaching lowers costs in the production of the intricate shapes of these copper breaker points. Seven pieces at a time are broached at a rate 30 times faster than by milling. 75,000 pieces are completed before it is necessary to sharpen the broach. 800 to 1000 pieces per hour are broached on one Colonial machine with only two sets of Colonial broaches.

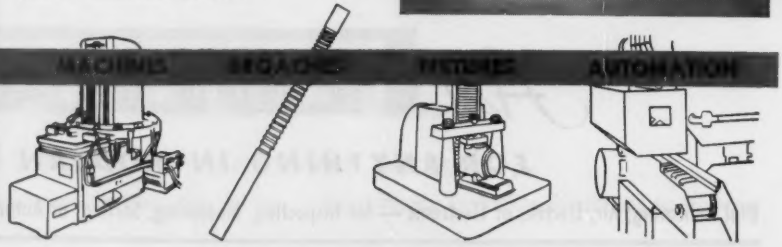


TWENTY TIMES FASTER than other methods—the serrations on the end of this shaft are cut with a button broach in a single pass. Cost per part is reduced substantially because broaching is 20 times faster. This, and hundreds of other applications on file at Colonial, are ample testimony of the tremendous cost-cutting potential that can be yours by utilizing "Unified Broaching" by Colonial. Send us prints of your parts—let us show you how to cut costs over your present machining methods.



Unified Broaching

COLONIAL



For more information on products advertised, use Inquiry Card, page 243

This Month's

GEAR PIX



HIGH SPEED HOBBERS—Michigan Tool's improved 1458-A Ultra-Speed gear hobbers are being used in ever increasing numbers in the gear industry. This battery of Ultra-Speed hobbers being assembled are the fastest single spindle hobbers made today.



COARSE PITCH GEARS—A typical 3½ pitch 10-inch diameter gear with a 1⅞ inch face width is cut on this heavy duty SHEAR-SPEED® gear shaper in less than 3½ minutes. Over five pounds of chips are removed in the process.

MICHIGAN TOOL COMPANY

7171 E. McNICHOLS RD. • DETROIT 12, MICH.

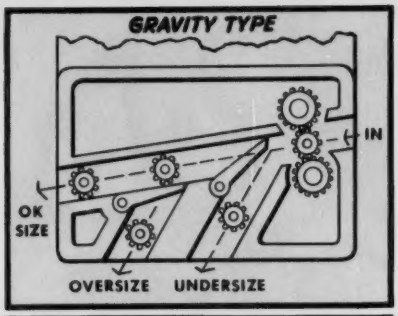
IN CANADA: COLONIAL TOOL CO., LTD.

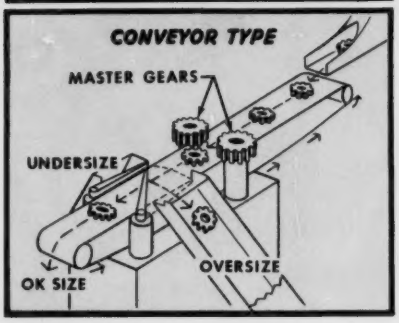
Over

This Month's

GEAR PIX



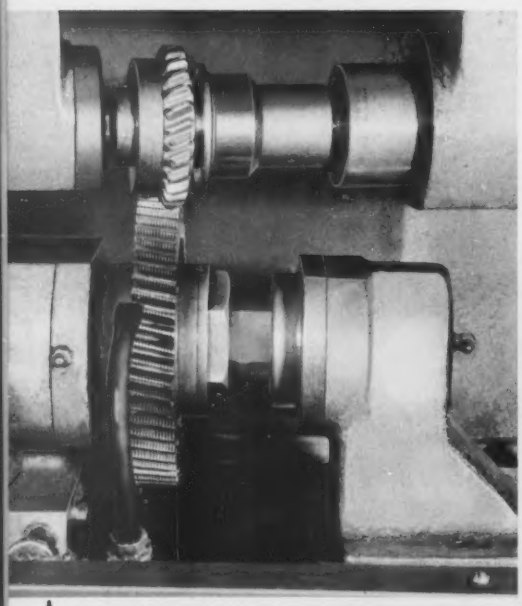




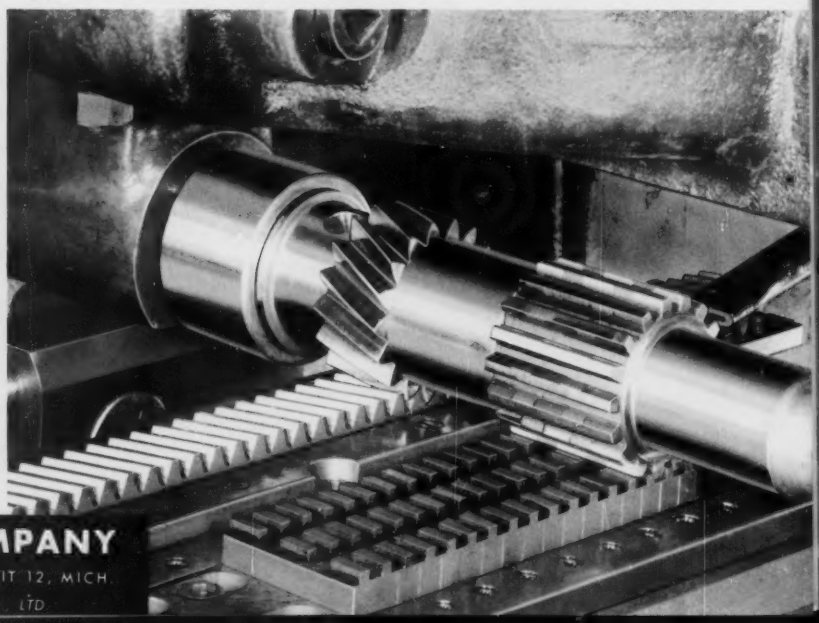
GEAR SELECTORS -Gravity and conveyor-type systems, custom made for size-checking of gears, are available in the new automatic 3-WAY gear selectors. Automatic shut-offs can be incorporated into selectors located in a production line with full automation or one in which the operator feeds the gears manually. 3-WAY selectors can be used to inspect any spur or helical gear at a much more rapid rate than gear cutting or finishing machines can turn out gears.

ANNOUNCING –The SINE-LINE® model 1136 involute checker capable of handling large external and internal spur or helical gears up to 36-inch diameter, with a maximum spread between centers of 26 inches, has been added to the Michigan line of checking equipment. This checker may also be used to check tooth spacing. Checking principle is based on a single master disc, combined with a sine bar. No extra base forms or master base circle discs are required.

STEP SHAVING –Alternately thick and thin steps on the tooth faces of this splined main drive shaft are shaved in a two minute cycle on a Michigan 900 rack type gear finisher. A master rack, offset relative to the shaving rack, guides the master helical gear mounted on the work arbor, in progressively removing 8 to 12 thousandths of metal to form steps in the face of the spline teeth.



MODIFIED UNDERPASS SHAVING
Modified underpass method shaves this tough steel sliding low and reverse gear in 30 seconds. A Michigan 870 Underpass gear finisher easily handles 120 of the 3.833″ O.D. and 0.735″ face width gears every hour.



MICHIGAN TOOL COMPANY
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Over

It MUST have been good!

There are times when expressions speak louder than words.

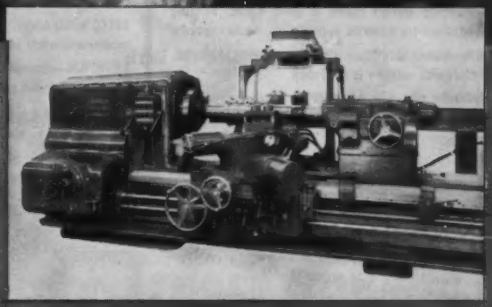


Here's a group of distinguished steel mill roll executives watching a demonstration on a 26" Capacity "AMERICAN" Hydraulic Roll Lathe—judge for yourself whether or not they are satisfied with what they saw.

These machines are performing "miracles" in savings in many of the best known roll shops in the country. They have introduced a brand new machining technique that has revolutionized the art of roll turning. They reproduce work shapes from a template faithfully and accurately not only on steel mill roll bodies and necks, but on such work as spindles, motor shafts, valve stems, step shafts, piston rods, axles and a wide variety of chucking work having irregular contours.

Evidence from hundreds of installations proves beyond a shadow of a doubt their leadership as top-flight cost reducers. Was there ever a time when cost reduction was more urgently needed?

If it's proof you want just drop us a line—no obligation.



THE AMERICAN TOOL WORKS CO. Cincinnati 2, Ohio, U. S. A.

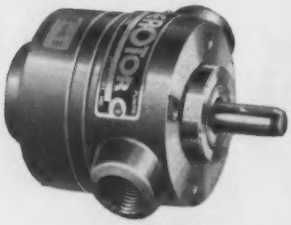
LATHES AND RADIAL DRILLS

7171 E. McNICHOLS RD. • DETROIT 12, MICH.
IN CANADA: COLONIAL TOOL CO., LTD.

THAT FINE LINE OF PERFECTION

There's a GEROTOR HYDRAULIC PUMP *to meet your requirements!*

The GEROTOR line of precision engineered hydraulic pumps is designed to fill the requirements of the majority of hydraulic equipment users. The three standard GEROTOR models cover a range of g.p.m. delivery from 4 g.p.m. to 40 g.p.m. Check the selection data for the pump to fill your needs.



TYPE QDB

Gerotor's NEW QDB series of small capacity pumps . . . the last word in precision engineering.

DELIVERY G.P.M. — 1800 R.P.M.					
TYPE	DISCHARGE PRESSURE P.S.I.				
	0	250	500	750	1000
QDB .4	.42	.40	.38	.35	.31
QDB .75	.84	.80	.78	.73	.66
QDB 1.5	1.67	1.62	1.57	1.50	1.42

Selection Data

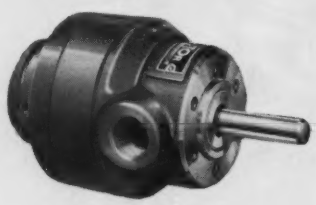
HORSEPOWER REQUIRED — 1800 R.P.M.					
TYPE	DISCHARGE PRESSURE P.S.I.				
	0	250	500	750	1000
QDB .4	.08	.16	.24	.33	.41
QDB .75	.13	.27	.41	.56	.71
QDB 1.5	.16	.42	.70	1.00	1.28

PRESSURE—Maximum continuous operating pressure is 1000 p.s.i.

SPEED—Standard design speed is 1800 r.p.m. Specific recommendations are made for applications at other speeds.

ROTATION—Standard rotation is clockwise facing shaft end. Counter-clockwise rotation is available.

OIL—Hydraulic oils with viscosity of approximately 300 s.s.u. at 100° F. are recommended.



TYPE QDH

The QDH . . . popular intermediate size of the Gerotor line

DELIVERY — G.P.M. AT 1200 R.P.M.							
TYPE	DISCHARGE PRESSURE P.S.I.						
	0	250	500	750	1000	1200	1500
QDH 3	3.3	3.2	3.1	3.0	2.9	2.7	2.5
QDH 5	5.6	5.4	5.3	5.2	5.1	4.8	4.4
QDH 8	8.6	8.5	8.4	8.3	8.2	8.1	7.8
QDH 12	12.9	12.8	12.7	12.5	12.3	12.2	11.8

Selection Data

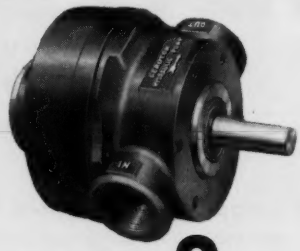
HORSEPOWER REQUIRED AT 1200 R.P.M.							
TYPE	DISCHARGE PRESSURE P.S.I.						
	0	250	500	750	1000	1200	1500
QDH 3	.25	.7	1.2	1.6	2.1	2.5	3.4
QDH 5	.33	1.1	1.8	2.5	3.2	3.7	4.6
QDH 8	.4	1.5	2.7	4.2	5.4	6.3	7.9
QDH 12	.5	2.3	4.2	6.1	8.0	9.6	11.7

PRESSURE—Maximum continuous operating pressure is 1200 p.s.i., maximum intermittent 1500 p.s.i.

SPEED—Standard design speed is 1200 r.p.m. Specific recommendations are made for applications at other speeds.

ROTATION—Standard rotation is clockwise facing shaft end. Counter-clockwise rotation is also available.

OIL—Hydraulic oils with viscosity of approximately 300 s.s.u. at 100° F. are recommended.



TYPE O

Gerotor Series O . . . when larger capacities are needed

DELIVERY — G.P.M. AT 1200 R.P.M.					
TYPE	DISCHARGE PRESSURE P.S.I.				
	0	250	500	750	1000
O-20	20.0	19.5	18.8	18.0	17.2
O-25	25.0	24.5	24.0	23.2	22.2
O-30	31.2	31.0	30.5	29.8	29.0
O-40	43.0	42.5	42.0	41.5	40.0

Selection Data

HORSEPOWER REQUIRED AT 1200 R.P.M.					
TYPE	DISCHARGE PRESSURE P.S.I.				
	0	250	500	750	1000
O-20	1.0	4.0	7.2	10.5	13.5
O-25	1.5	5.0	8.6	12.0	15.6
O-30	2.0	6.5	10.9	15.5	19.5
O-40	3.0	9.0	15.0	21.0	27.5

PRESSURE—Maximum continuous operating pressure is 1000 p.s.i., except type O-40, which is recommended for only intermittent duty at 1000 p.s.i.

SPEED—Standard design speed is 1200 r.p.m. Specific recommendations are made for applications at other speeds.

ROTATION—Standard rotation is clockwise facing shaft end. Counter-clockwise rotation is available.

OIL—Hydraulic oils with viscosity of approximately 300 s.s.u. at 100° F. are recommended.

Whatever your needs in hydraulic pumps . . . consult the GEROTOR engineers. Write for FREE literature and information, no obligation, of course.

GEROTOR MAY CORPORATION
P. O. Box 86—Baltimore 3, Maryland

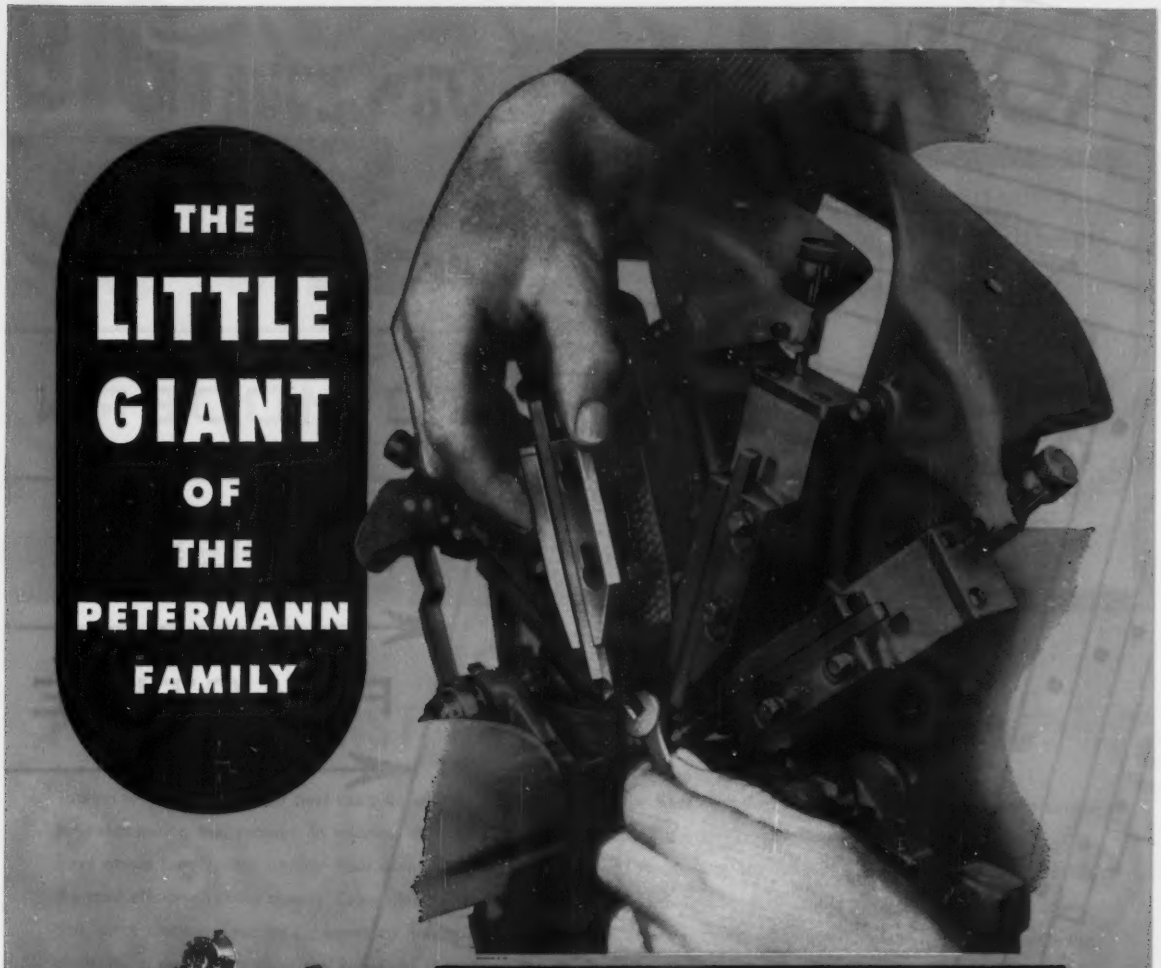
GEROTOR

HYDRAULIC PUMPS — HYDRAULIC MOTORS

Pneumatic Bin Evacuators — Precision Contract Manufacturing

For more information on products advertised, use Inquiry Card, page 243

THE LITTLE GIANT OF THE PETERMANN FAMILY



The P-4 AUTOMATIC



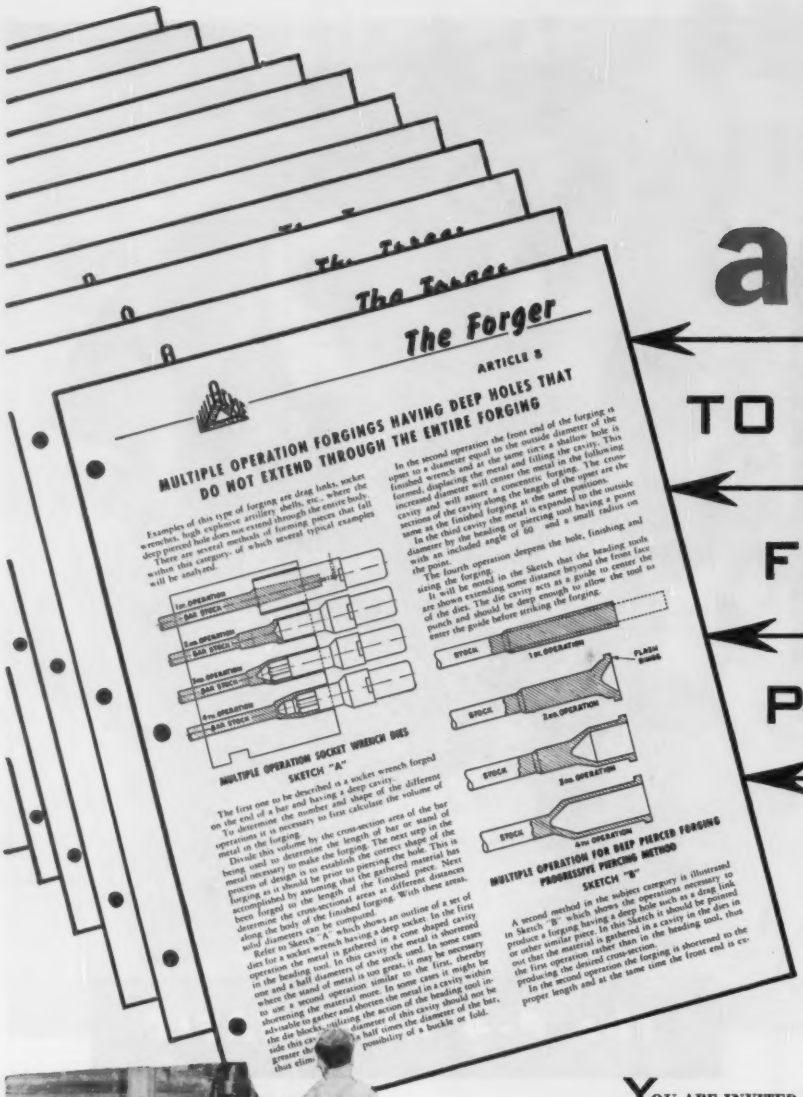
For work within its capacity (pieces 5/32" in diameter and 1½" long) we offer a machine of deadly accuracy and high production . . . 10 speeds to 12,000 RPM.

On this page we can show only *one* of the P-4's salient advantages . . . the ability to remove a tool for sharpening without removing it from the tool holder . . . *and grinding in place.*

The many other advantages are described in Catalog sent on request.

RUSSELL, HOLBROOK & HENDERSON, INC.

292 Madison Avenue, New York 17, N. Y.



aids TO MODERN FORGING PRACTICE



YOU ARE INVITED to have your name placed on our mailing list to receive this valuable series of articles on up-to-date forging methods. We will be glad to send a complete set of all eleven issues of "The Forger" in addition to placing your name on our mailing list to receive future issues as they are prepared. There is absolutely no charge for this service. We are glad to make this gesture towards the advancement of modern forging practice as executed on ACME XN Forging Machines.

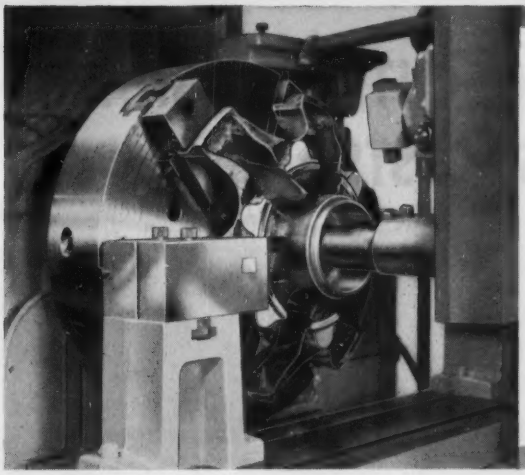
THE HILL ACME COMPANY

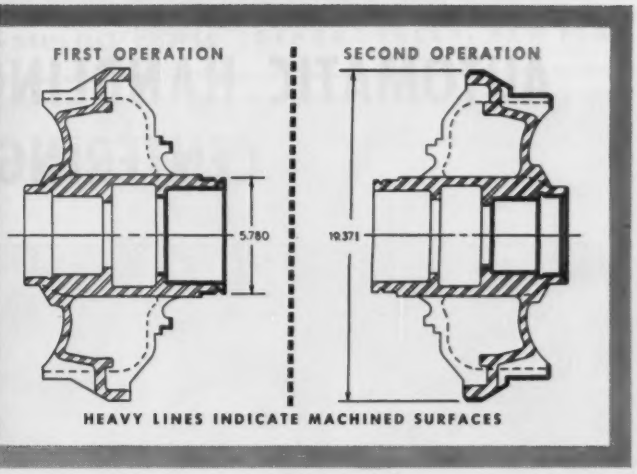
ACME MACHINERY DIVISION • **1203 W. 65th St., Cleveland 2, Ohio**
ESTABLISHED 1882

"ACME" FORGING • THREADING • TAPPING MACHINES • ALSO MANUFACTURERS OF "HILL" GRINDING AND POLISHING MACHINES
HYDRAULIC SURFACE GRINDERS • "CANTON" ALLIGATOR SHEARS • PORTABLE FLOOR CRANES • "CLEVELAND" KNIVES • SHEAR BLADES

For more information on products advertised, use Inquiry Card, page 243

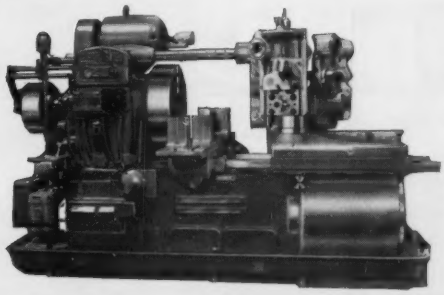
BIG TRUCK WHEELS ARE TURNED *FAST*





BY THE POTTER & JOHNSTON 6-DRE *Automatic Turret Lathe*

Tooling to machine this cast steel truck wheel, P&J Engineers used pilot bars engaging a bushing in the main spindle center for extra boring tool support. In addition the massive turret slide and the overhead pilot construction of the Model 6-DRE gave ample turning tool rigidity. Four automatic speed changes and three automatic feed changes were selected to provide the most effective cutting speeds. Cross slide tools permitted multiple machining for further time savings. In the second operation, piece clamping was by air operated fingers located between the spokes, pulling the work against a ground positioning plate. Here, positioning accuracy, equalized clamping pressure and fast action contributed greatly to close tolerance, high performance work.



Over 50 years of production know-how went into the high quality and economy of automatic operation in this typical example — one more tribute to the versatility and capacity of P&J automatic chucking and turning machines. Bulletin 128, yours for the asking, gives details of the Model 6-D machines. If you prefer, get your facts from the nearest Pratt & Whitney Branch Office — or send us your parts or prints for estimating purposes. There is never any obligation.

MODERNIZE with POTTER & JOHNSTON REPLACE FOR PROFIT

WRITE DIRECT OR CONTACT YOUR NEAREST PRATT & WHITNEY BRANCH OFFICE . . .

BIRMINGHAM • BOSTON • CHICAGO • CINCINNATI • CLEVELAND • DETROIT • LOS ANGELES • NEW YORK • PHILADELPHIA • PITTSBURGH • ROCHESTER • SAN FRANCISCO • ST. LOUIS • EXPORT DEPT., PAWTUCKET, RHODE ISLAND

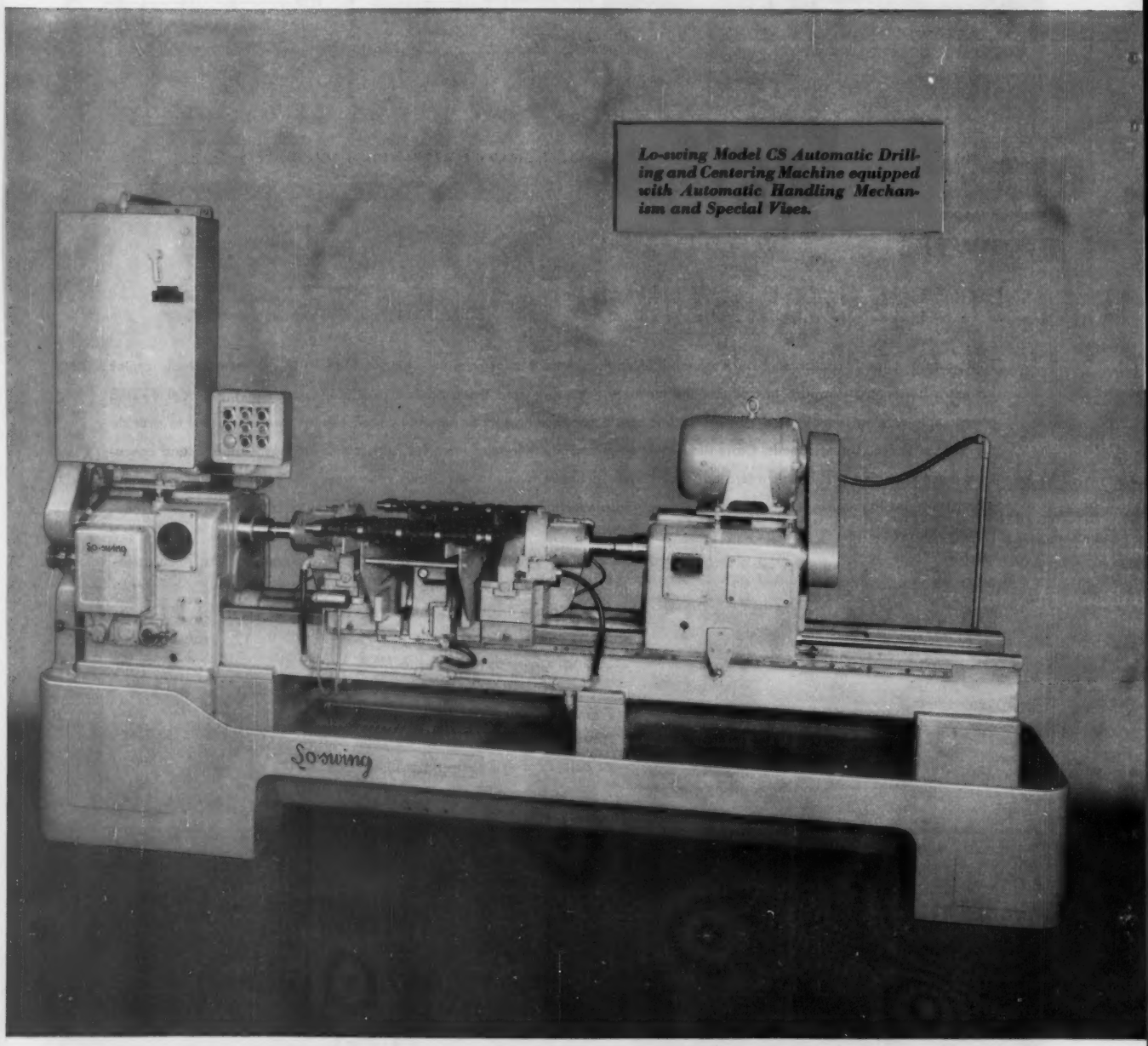
AGENTS: DALLAS, THE STANCO CO. HOUSTON, WESSENDORFF, NELMS & CO.

POTTER & JOHNSTON CO.
PAWTUCKET, RHODE ISLAND
SUBSIDIARY OF
PRATT & WHITNEY
DIVISION NILES – BEMENT – POND COMPANY

PRECISION PRODUCTION TOOLING P&J FOR OVER FIFTY YEARS

MACHINE OF

AUTOMATIC HANDLING CUTS CAMSHAFT CENTERING COSTS

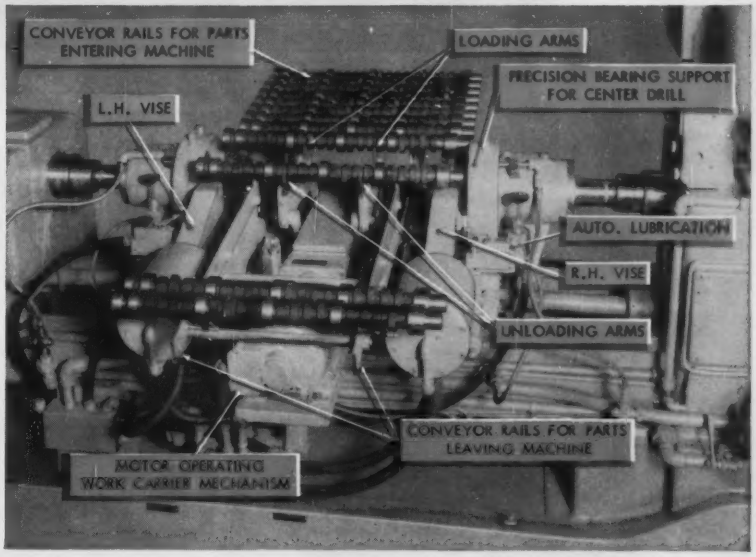


Lo-swing Model CS Automatic Drilling and Centering Machine equipped with Automatic Handling Mechanism and Special Vises.

PRODUCTION COSTS

THE MONTH

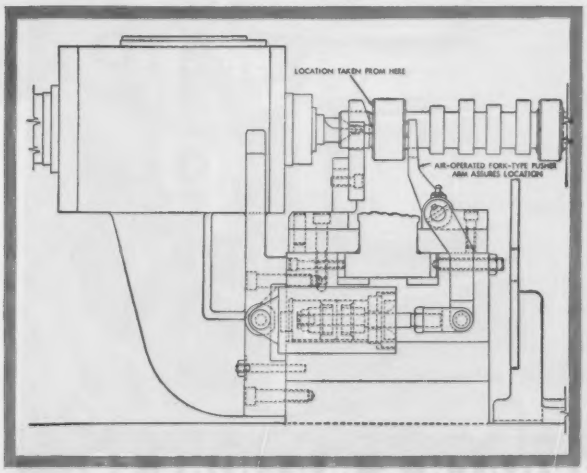
PREPARED BY THE SENECA FALLS MACHINE CO. "THE *Lo-swing* PEOPLE" SENECA FALLS, NEW YORK



PROBLEM: To automatically handle and center both ends of eight-cylinder camshafts.

SOLUTION: The standard *Lo-swing* Model CS Automatic Drilling and Centering Machine selected for this job was equipped with a special Automatic Handling Mechanism and special vises. The close-up illustration provides a rear view of the vises, loading and unloading arms, and rails which guide the camshaft through the machine.

The camshafts arrive at the machine from the previous operation by conveyor and roll down to a fixed stop on the loading rails. At the end of the machine cycle, the center drills retract and the vises open, allowing the finished piece to drop into a stationary cradle, which is positioned slightly lower than the center line of the vise jaws. An electrical contact then starts the work carrier motor, imparting a rotating movement to the work carrier arms which handle a rough and finished piece simultaneously.



The unloading arms remove the finished piece, depositing it on the conveyor rails leaving the machine, while the loader arms, in their trajectory, pick up a rough part and lower it into the vise jaws where it is automatically clamped in position. The machine starting clutch is then automatically engaged and the part centered, which completes the cycle. The entire operation is automatic, no operator being required.

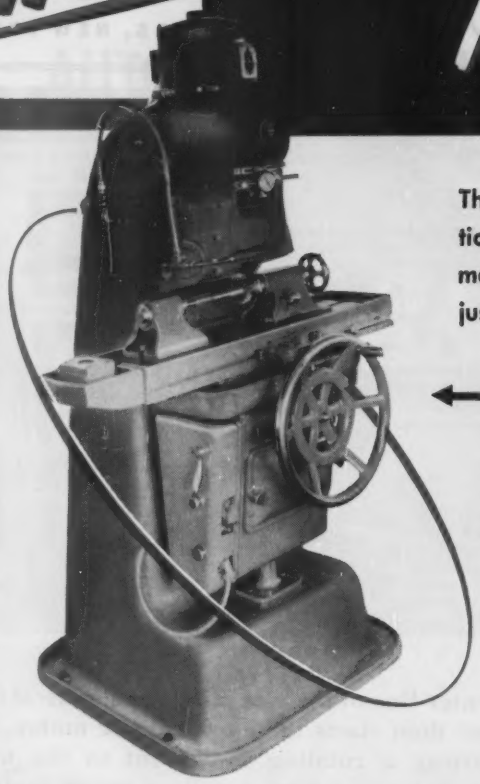
The close-up illustration shows a finished part being removed from the vises and a rough part just being lowered into the vise. The line drawing shows the details of the automatic positioning stop attached to the left hand vise.

Seneca Falls engineers are at your disposal for solving your AUTOMATION problems.

SENECA FALLS MACHINE CO., SENECA FALLS, N. Y.

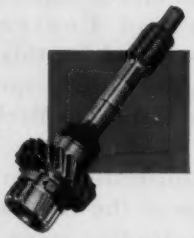
ARE LOWER WITH *Lo-swing*

NOW IS THE TIME TO Cut Manufacturing Costs



The one sure way of meeting today's competition is with today's machine tools. The older machines were all right in their day but they just haven't got what it takes now.

← **For instance,** it took this old Red Ring Model GCC 60 seconds to shave a gear like the one shown. →





Model GCU today finishes that same gear in just 16 seconds—and to much closer tolerances, too.

In an 8 hour day the GCU will deliver 375% of the production of its predecessor.

Write for Bulletin S 53-7 to get all the facts on these new cost saving gear shaving machines.

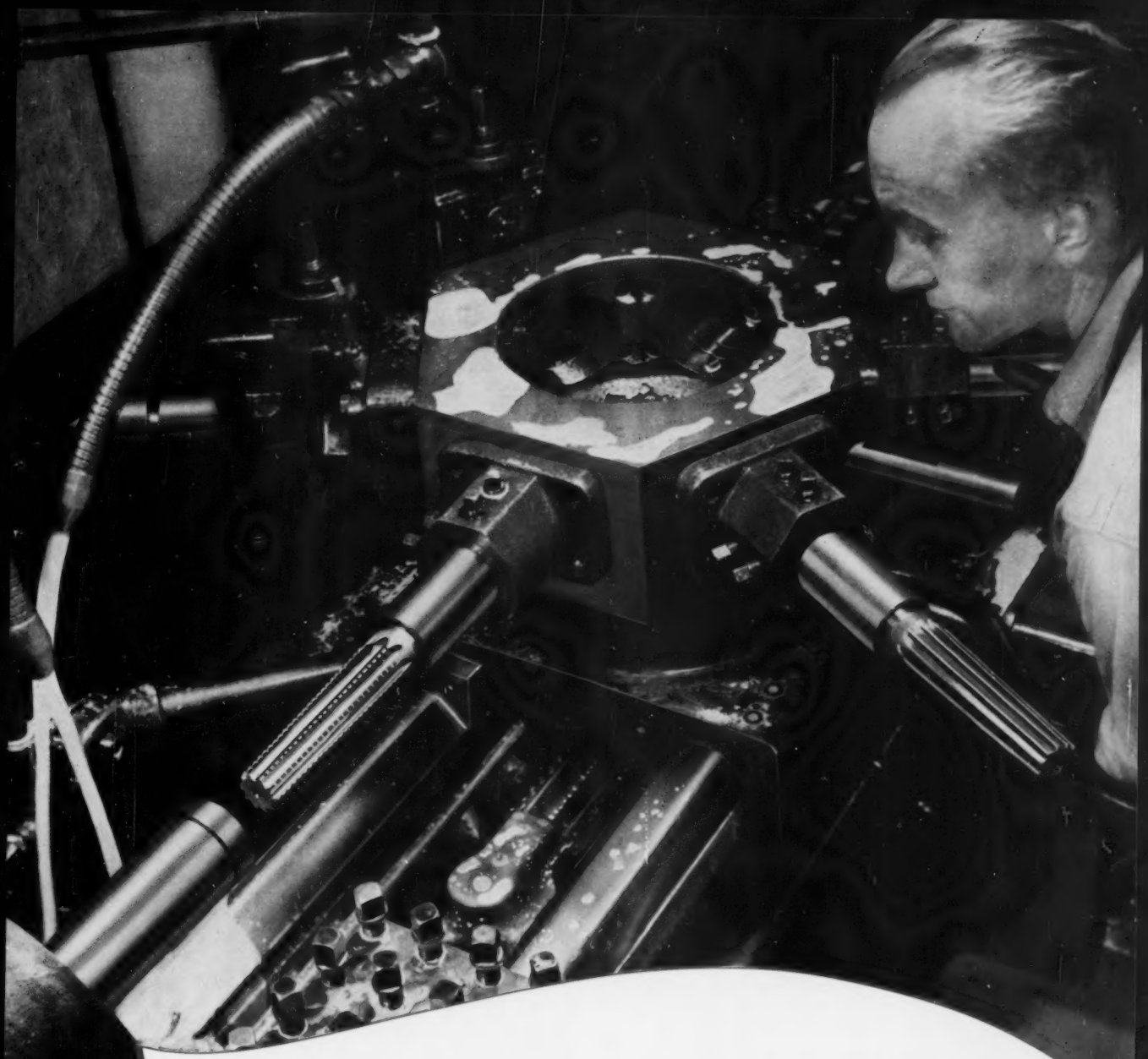


NATIONAL BROACH & MACHINE CO.

5600 ST. JEAN . . . . . DETROIT 13, MICHIGAN

WORLD'S LARGEST PRODUCER OF GEAR SHAVING EQUIPMENT

For more information on products advertised, use Inquiry Card, page 243



SPECIFY CLEVELAND REAMERS

For Smooth Finish and Economy

A *complete* line of Reamers, offering a wide range of types and sizes for every requirement. All are correctly engineered to give you accuracy, efficiency, long life and *more holes per grind.*

THE CLEVELAND TWIST DRILL CO.

1242 East 49th Street • Cleveland 14, Ohio

Stockrooms: New York 7 • Detroit 2 • Chicago 6 • Dallas 2 • San Francisco 5 • Los Angeles 58

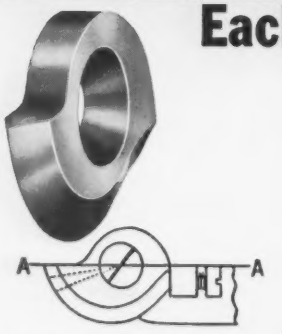
E. P. Barrus, Ltd., London W. 3, England

TELEPHONE YOUR INDUSTRIAL SUPPLY DISTRIBUTOR

For more information on products advertised, use Inquiry Card, page 243

ARMSTRONG





The ARMSTRONG Threading Tool takes interchangeable high speed steel form-cutters which require only flat top grinding to resharpen—always hold their true thread form.

Each year ARMSTRONG TOOL HOLDERS become more important to you

Every rise in labor costs, every added tax, every overhead burden, every increase in cutting steel prices, every new, more costly machine tool, all increase the importance of ARMSTRONG TOOL HOLDERS to profitable operation.

ARMSTRONG TOOL HOLDERS reduce direct tooling costs to an absolute minimum—"Save: All Forging, 70% Grinding, 90% High Speed Steel."

ARMSTRONG TOOL HOLDERS reduce tooling-up time to minutes, to the selection and adjustment of the holder and cutter.

ARMSTRONG TOOL HOLDERS permit increased speeds and feeds—produce more pieces per hour per machine tool.

ARMSTRONG TOOL HOLDERS are efficient for they embody a perfection gained by over 50 years of specialization in the development and refinement of tool holders.

ARMSTRONG TOOL HOLDERS are inexpensive because they are quantity produced by modern methods, for a world market . . . are used by over 96% of the machine shops and tool rooms . . . are carried in stock for your convenience by all industrial distributors of consequence.

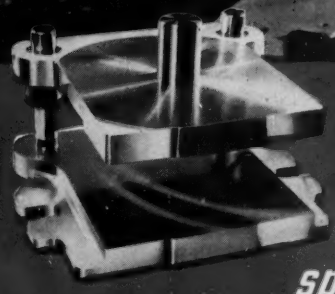
Buy ARMSTRONG TOOLS from your Industrial Distributor

Write For Catalog

ARMSTRONG BROS. TOOL CO. "The Tool Holder People" 5213 W. ARMSTRONG AVENUE CHICAGO 30, ILL.



At Danly's Chicago Plant . . . final broaching to assure accurate sizing and parallelism of guide post and bushing holes



World's fastest die set service speeds up your tooling program

Mass production plus local stock means faster delivery

DANLY

DANLY MACHINE SPECIALTIES, INC.
2100 South Laramie Avenue
Chicago 50, Illinois



At a Danly Branch Plant . . . complete stocks of die set components ready for assembly to your order

*CHICAGO 50
2100 South Laramie Avenue
*CLEVELAND 14
1550 East 33rd Street
*DAYTON 7
3196 Delphos Avenue
*DETROIT 16
1549 Temple Avenue
*GRAND RAPIDS
113 Michigan Street N.W.
INDIANAPOLIS 4
5 West 10th Street
*LONG ISLAND CITY 1
47-28 37th Street

FAST, NATIONWIDE DELIVERY FROM THESE BRANCHES

Danly's new, faster service starts at the main Danly Plant in Chicago where two unique, high-speed, mass production lines are devoted exclusively to the manufacture of interchangeable, precision die set parts. Stocked by Danly Branch Plants in major toolmaking centers, these interchangeable parts are quickly assembled to make up the size and type of die set you need—and delivered to you only a few days after your order is received. Make a note right now of the Danly Branch nearest you from the list given on this page. Next time you need die sets, give your Danly Branch a call. See how they can meet your needs from stock . . . and save you time with fast, local service.

*LOS ANGELES 54
Ducommun Metals & Supply Co.
4890 South Alameda
MILWAUKEE 2
111 East Wisconsin Avenue
*PHILADELPHIA 40
511 W. Courtland Street
*ROCHESTER 6
33 Rutter Street

*Indicates complete stock

Carlton *Only one*

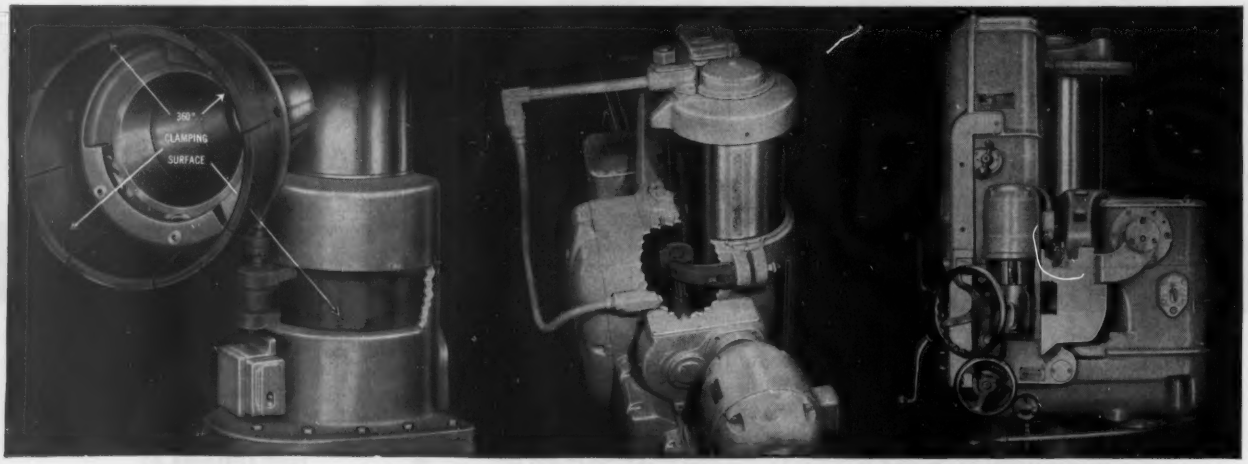
Carlton's exclusive 3-unit power-operated mechanical clamping of arm, head and column is easier, faster and costs less to operate

ELECTRO-HYDRAULIC POWER is used to actuate mechanical clamping devices on arm, head and column of Carlton radials. Once any of these units is clamped or unclamped, mechanical devices hold them in position until the electro-hydraulic power is applied again.

Electric power is used only when clamping or unclamping . . . results in noticeable savings in electric power consumption.

The hydraulic pressure required in Carlton electro-hydraulic clamping systems is comparatively low . . . so that there is positively no leakage of oil from any unit. Each unit has its own individual oil reservoir . . . and the oil from the Arm reservoir is used to lubricate the Column.

Due to the use of electrical interlocking, overload relays and safety valves, it is impossible to overload Carlton electro-hydraulic clamping systems either electrically or mechanically.



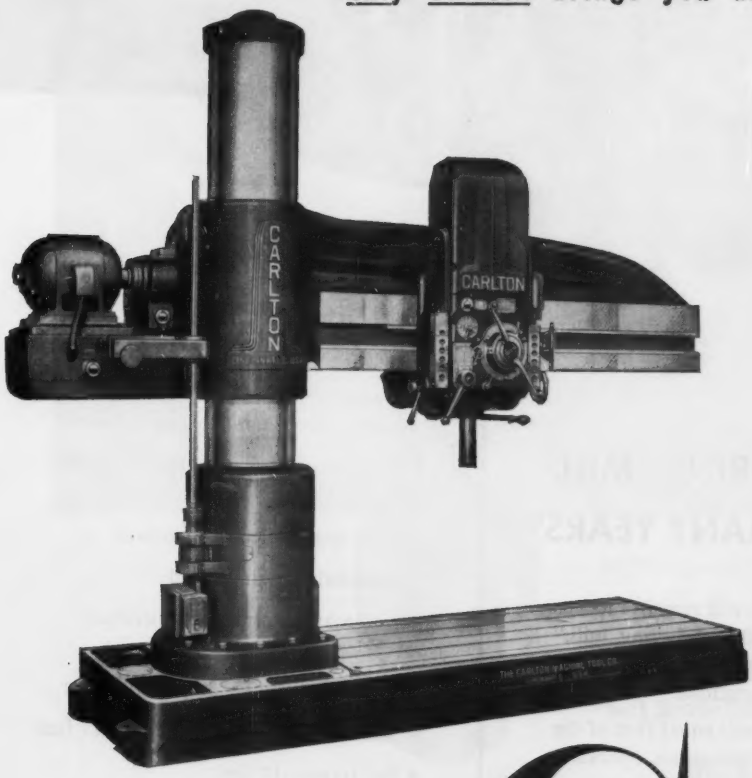
column clamp...arm clamp...head clamp

can be called the finest . . .



CENTRALIZED CONTROLS:
All controls necessary for quickly and accurately locating the drill from one hole to the next are centralized at the head . . . all located within the spread of a man's hand.

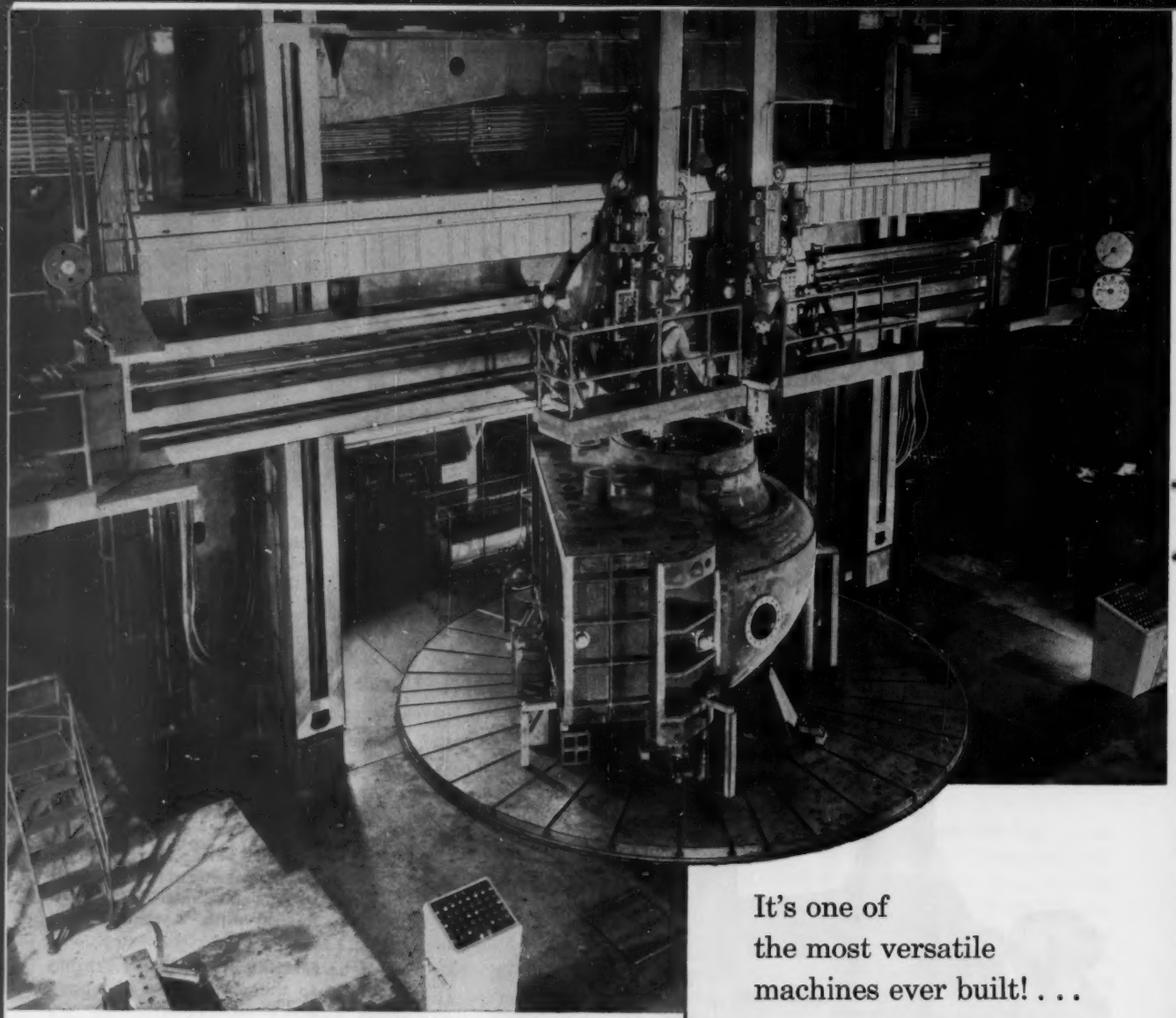
only Carlton brings you all these radial drill advantages:



- **CENTRALIZED CONTROLS** (see above).
- **3-UNIT POWER CLAMPING:** column, arm, head (see opposite page).
- **LOW HUNG DRIVE** . . . drives on largest diameter of the spindle . . . permits maximum torq transmission with a minimum of spindle twist.
- **FREE AND EASY RUNNING** . . . thanks to the generous use of tapered and straight roller bearings and ball bearings.
- **EASY TO MAINTAIN** . . . parts jig machined for absolute interchangeability.
- **THE RIGHT RADIAL** for you: select your Carlton from among 5 models, 26 different arm and column sizes. Why not send for descriptive bulletins today?

Carlton

THE CARLTON MACHINE TOOL CO., CINCINNATI 25, OHIO



Allis-Chalmers Says:

"OUR NILES 30 FT. BORING MILL WILL BE MODERN FOR MANY YEARS"

"Advanced controls and speed ranges which will remain modern for decades were what we wanted in a 30-foot boring mill," Allis-Chalmers reveals. "This Niles-built mill at work in our Milwaukee plant has fully met its high expectations.

"It is felt that its ruggedness and reliability will equal that of the 40-foot mill built by Niles in 1928 and in continuous operation at Allis-Chalmers for 25 years."

New Catalog! Write for details on the Niles standard line of vertical boring mills to 43 feet, side-head mills to 54 inches, 6-inch horizontal mills, heavy duty engine lathes to 120 inches.

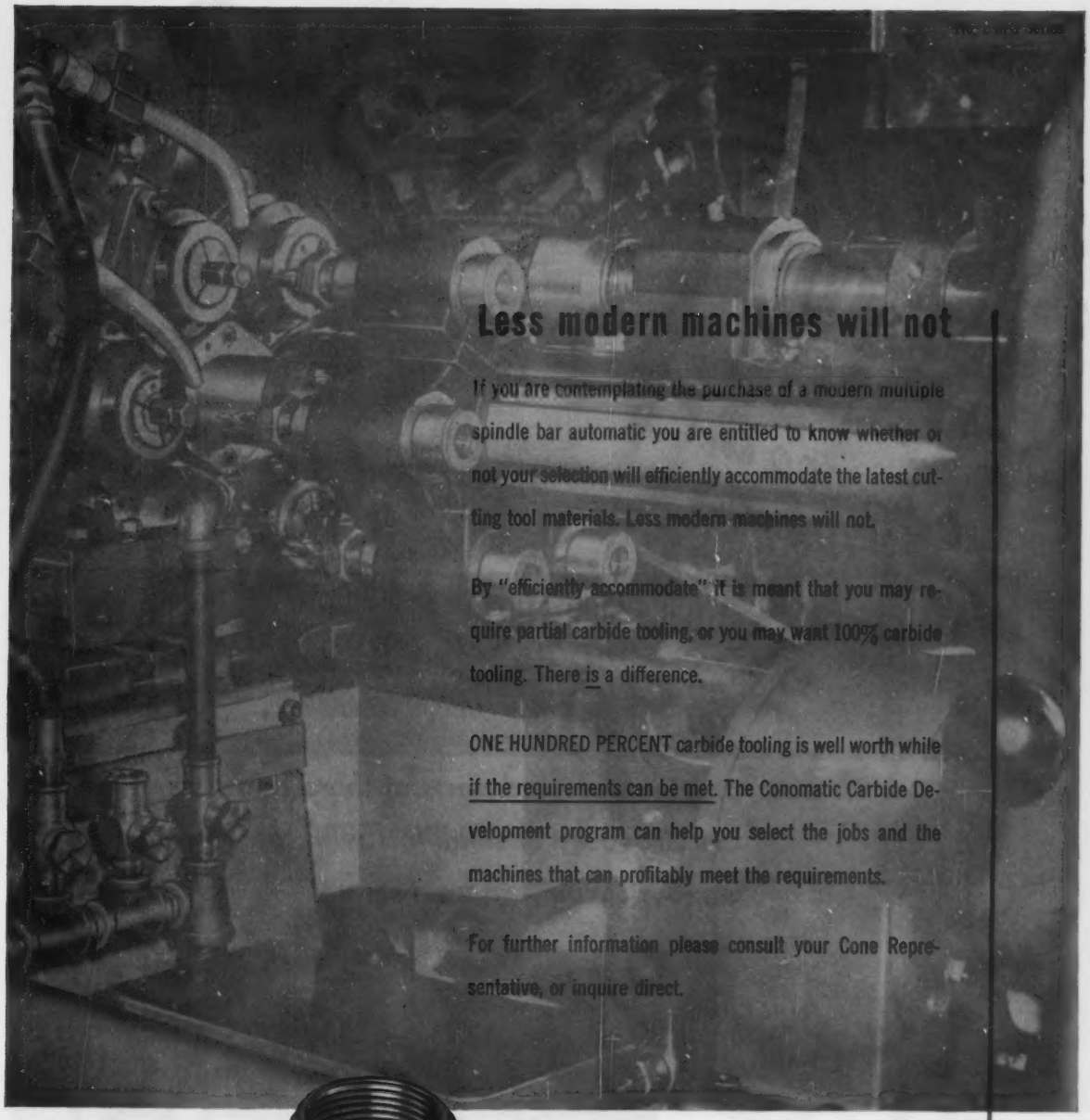
It's one of the most versatile machines ever built! . . .

- ★ Electrical control of all movements except where hand setting is desired
- ★ 45-degree motor-operated swivel of boring bars
- ★ Four station electrical control
- ★ Detachable milling head
- ★ Automatic warning of incorrect lubrication
- ★ Maximum swing—30 feet, 5 inches
- ★ Maximum height under tool—17 feet
- ★ Bar travel—10 feet

BALDWIN BLH LIMA-HAMILTON

BALDWIN—LIMA—HAMILTON

Hamilton Division, Hamilton, Ohio



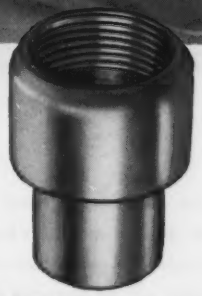
Less modern machines will not

If you are contemplating the purchase of a modern multiple spindle bar automatic you are entitled to know whether or not your selection will efficiently accommodate the latest cutting tool materials. Less modern machines will not.

By "efficiently accommodate" it is meant that you may require partial carbide tooling, or you may want 100% carbide tooling. There is a difference.

ONE HUNDRED PERCENT carbide tooling is well worth while if the requirements can be met. The Conomatic Carbide Development program can help you select the jobs and the machines that can profitably meet the requirements.

For further information please consult your Cone Representative, or inquire direct.



MATERIAL—1040 STEEL

	HSS	CARBIDE
Cycle Time	*	30 secs.
Work Spindle Speed	*	670 R.P.M. at 160 S.F.
Tool Wear	*	2000 pcs. per grind

*Hot rolled material prevents fair comparison



Conomatic

CONE AUTOMATIC MACHINE COMPANY, INC. WINDSOR, VT., U.S.A.

Hamilton Division, Hamilton, Ohio



Wiedemann Turret Punch Presses

Pay Off **IN TWO YEARS OR LESS . . .**

(4000 hours of operation)

precision-pierced parts of these and similar products are produced in small lots with low tooling cost

WITHOUT LAYOUT—WITHOUT SET-UP



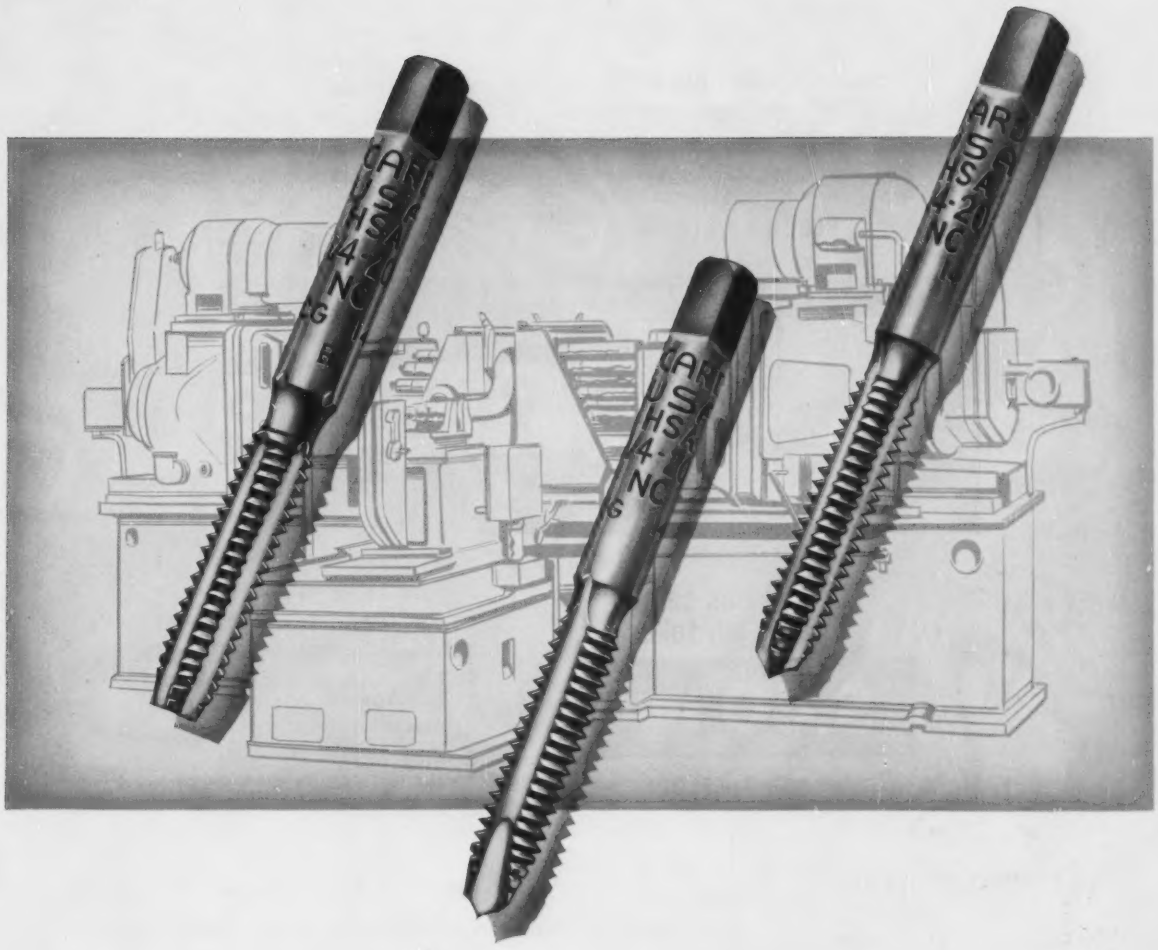
A WIEDEMANN PIERCES SMALL LOTS COMPLETE, IN LESS TIME THAN LAYOUT BY CONVENTIONAL METHODS

We'll gladly make a time study on your work.

WIEDEMANN MACHINE COMPANY

4205 Wissahickon Avenue, Philadelphia 32, Pa.

For more information on products advertised, use Inquiry Card, page 243



TAPS *by* CARD

In tapping steel, cast iron, aluminum alloys, bakelite, hard rubber or bronze, the excellence of the machine counts. But in the long run, maximum performance depends on the taps you use. With Card the quality is always assured.

The CARD Quality

Completely stocked offices at Atlanta, Chicago, Detroit, Fort Worth, Los Angeles, New York, San Francisco and Seattle

See your local Card distributor for prompt deliveries and helpful service

S. W. CARD MANUFACTURING CO., MANSFIELD, MASS. • DIVISION OF UNION TWIST DRILL CO. • **TAPS • DIES • SCREW PLATES**

For more information on products advertised, use Inquiry Card, page 243

This is the difference High Velocity Turning makes

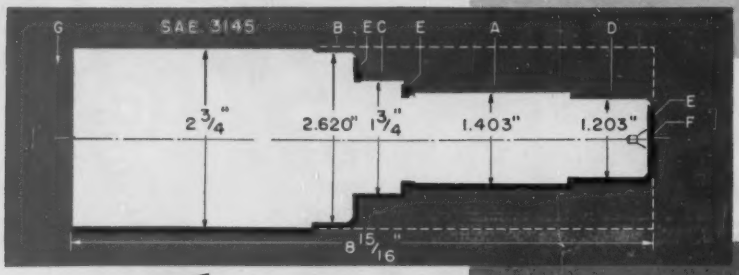


IN 1950 this job took...

12.40 min.

FLOOR TO FLOOR

A. Turn 489 RPM — .011 feed
B. Turn 340 RPM — .022 feed
C. Turn 489 RPM — .011 feed
D. Turn 489 RPM — .011 feed
E. Face end, shoulders & neck 489 RPM — .0055 feed
Chamfer
F. Center drill
G. Cut off 82 RPM — .0035 feed H.S.S.





IN 1954 this same job takes...

5.40 min.

FLOOR TO FLOOR

A. Turn 694 RPM — .022 feed
B. Turn 694 RPM — .022 feed
C. Turn 694 RPM — .022 feed
D. Turn 694 RPM — .022 feed
E. Face end, shoulders and neck — 694 RPM — .055 feed
Chamfer
F. Center drill
G. Cut off 489 RPM — .0025 feed

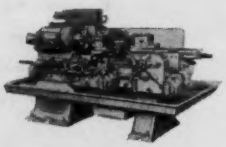
J & L TURRET LATHES GIVE...

MORE Ease of Operation
MORE Power Transmission
MORE Rigidity
MORE Accurate Stops
MORE Efficient Lubrication
MORE Coolant on Cutting Tools
MORE Accurate Results

Visitors who attend J &L's periodic "Production Studies" Seminars see this job turned out in just 5.40 min. on a Jones & Lamson #7A Universal Turret Lathe.

Only with lathes like this, built with plenty of power and the beef to back it up, can your shop take full advantage of the quality, productivity and lower costs offered by High Velocity Turning.

This job is one of the many turned at high speeds on our production line. Come to Springfield and see for yourself. At any rate, send for catalogs #101-A and #102.



JONES & LAMSON

Machine Tool Craftsmen Since 1835

JONES & LAMSON MACHINE CO., 512 Clinton St., Dept. 710, Springfield, Vt., U.S.A. J&L MACHINE TOOL DIV.

For more information on products advertised, use Inquiry Card, page 243

NORTON KNOW-HOW can bring the "TOUCH OF GOLD" to YOUR grinding

ONLY the correct grinding wheel on each job can give you minimum grinding costs — can bring to your grinding the "TOUCH OF GOLD" that is so necessary in these competitive times.

And right near you there's a Norton abrasive engineer or a factory-trained Norton distributor man who can see that you get that correct wheel. He's an expert in grinding wheel selection and he has the most complete variety of wheels in the industry to select from — including the exclusive 32 ALUNDUM abrasive and the new G bond.

Back of him, continually developing still better abrasives and bonds to do your grinding jobs even more economically, are the largest and best equipped research laboratories in the industry — plus the facilities of the world's largest and most modern grinding wheel plant.



Making better products... to make other products better

GRINDING KNOW-HOW
...in print ... in film ... in class

PAGES AND PAGES OF PRODUCTION-BOOSTING INFORMATION

Between the covers of these booklets and in the monthly technical magazine "Grits and Grinds" you'll find a wealth of grinding know-how — information on all phases of grinding, both tool room and production. The apprentice will find them invaluable and even the experienced operator will pick up many helpful hints for increasing production and cutting grinding costs.



A SERIES OF GRINDING FILMS WITH COLOR AND SOUND



"Lessons in Grinding" is the title of a series of eight motion picture films which are available to industrial apprentice schools, vocational schools, and other places where machine shop practice is being taught. There are also five other more general Norton films on grinding that are especially suitable for engineering groups and society meetings. All Norton films are loaned without charge — all are color 16mm. sound-on-film. Descriptive folders on reauest.

A SCHOOL OF GRINDING FOR GRINDING FOREMEN AND SUPERVISORS

A one-week course of visual and oral instruction at the Norton plant is available for grinding department and tool room foremen, process and time study engineers and training supervisors. The course is also available to college and school shop instructors. Classes are conducted in the well-equipped Norton School of Grinding and offer up-to-the-minute and practical instruction and demonstrations in the selection and efficient use of grinding wheels and other abrasive products.



For enrollment details and further information on the course, customers and educational institutions are invited to address their inquiries to Norton Company, Educational Service Department, Worcester 6, Massachusetts.

NORTON ABRASIVES

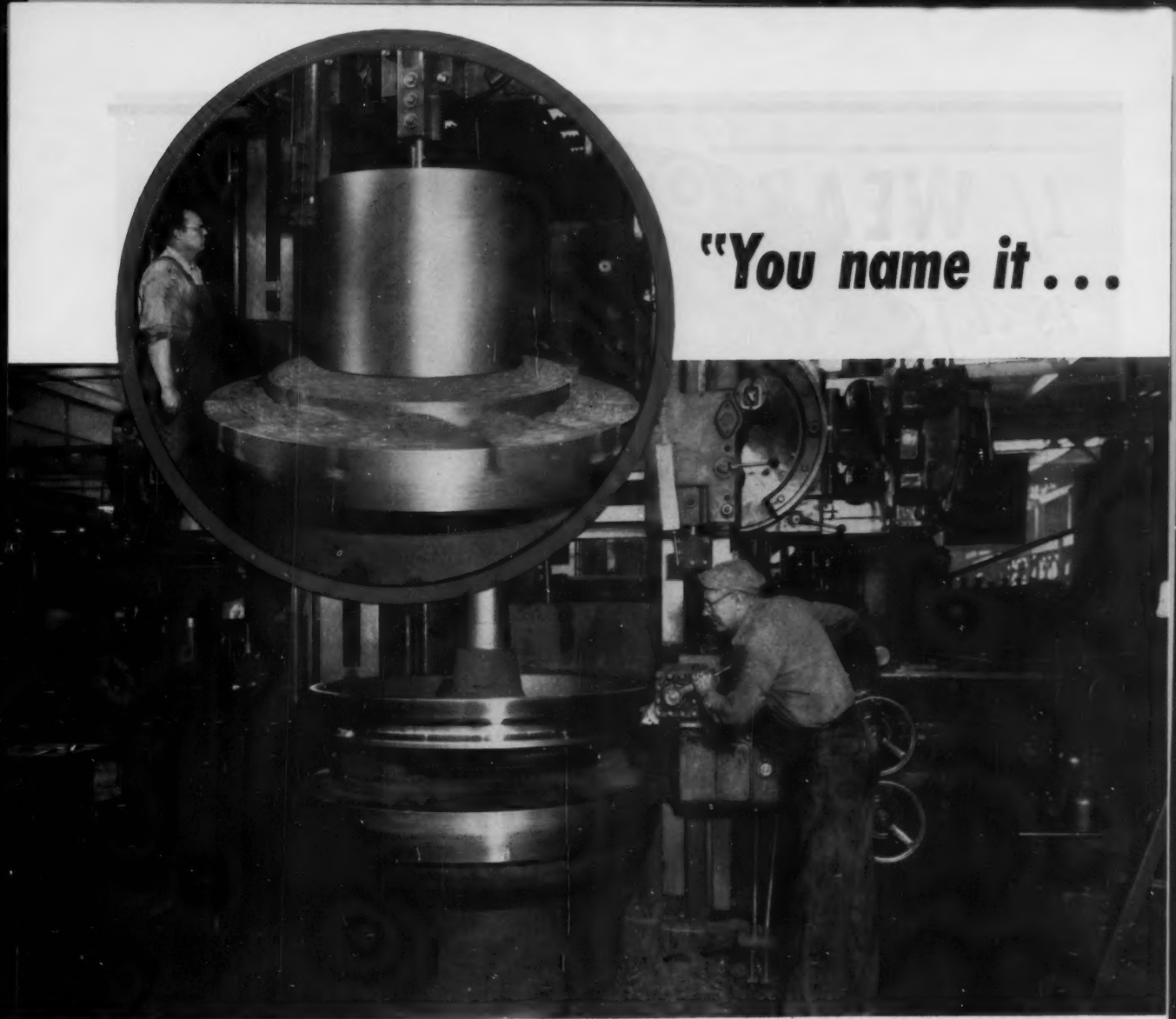
NORTON COMPANY, WORCESTER 6, MASS.

New York · Philadelphia · Pittsburgh · Chicago · Cleveland · Detroit · Hartford

Distributors in all principal cities — see your classified telephone directory

BEHR-MANNING DIVISION, TROY, N. Y.

Export: Norton Behr-Manning Overseas Inc., Worcester, Mass.



"You name it . . .

KING does it"

. . . at BELOIT IRON WORKS

Rugged KING® Vertical Boring & Turning Machines are noted for their durability, precision, and versatility. For example—at Beloit Iron Works, Beloit, Wisconsin, KINGS are called upon for *versatility plus* in machining grey iron castings. "Jobs run the gamut from light to heavy, large to small," says this customer. "There's boring, turning, facing, forming . . . taking light cuts, interrupted cuts, heavy cuts. In a word, we find that with KING machines it's a case of *you name it—King does it.*"

It will pay *you* to get first-hand information on the wide variety of precision work that KING machines can handle in your production. You, too, will find that in range of feeds and speeds, in ease of control, in extra weight and accuracy-maintaining rigidity, KING will meet *all* job requirements at a *profit.*

KING machines are available in ten sizes—30" to 144"—the widest size range in the field. See your KING distributor, or write us direct, for details.

AMERICAN STEEL FOUNDRIES

KING MACHINE TOOL DIVISION

Vertical boring & turning machines . . . 1150 TENNESSEE AVE., CINCINNATI 29, OHIO

If WEAR is a factor...



...use

VK CARBIDE PLUG GAGES

TUNGSTEN CARBIDE
wire type .016″ to .500″ diameter

CHROME CARBIDE
taper insert type .500″ to 1.510″ diameter

In addition to its regular line of tungsten carbide wire type plug gages from .016" to .500" diameter, The Van Keuren Company now offers a new line of chrome carbide taper insert plug gages in the range from .500" to 1.510" diameter.

Van Keuren tungsten carbide wire type gages have proved their worth on thousands of tough gaging jobs. The new chrome carbide taper inserts (Carboloy, grade #608*) promise to be equally effective. Wearing qualities of chrome carbide are comparable with tungsten carbide. In addition, the material is lighter than tungsten carbide and has a coefficient of expansion close to that of steel . . . both of which factors are a distinct advantage in the larger sizes.

Finish on Van Keuren gages in either tungsten carbide or chrome carbide will average .5 RMS or better. These gages are available in Class Y, X and XX accuracies at moderate prices and on a reasonable delivery basis.

Send for a copy of the 220-page Van Keuren Catalog and Handbook No. 35 containing valuable technical and engineering information on measuring problems and methods. Address: The Van Keuren Co., 178 Waltham St., Watertown, Mass.

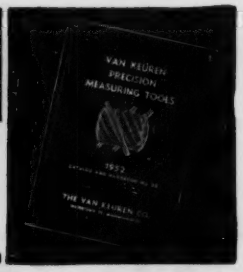
* Trademark of the Carboloy Dept. of General Electric Company.

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35th YEAR

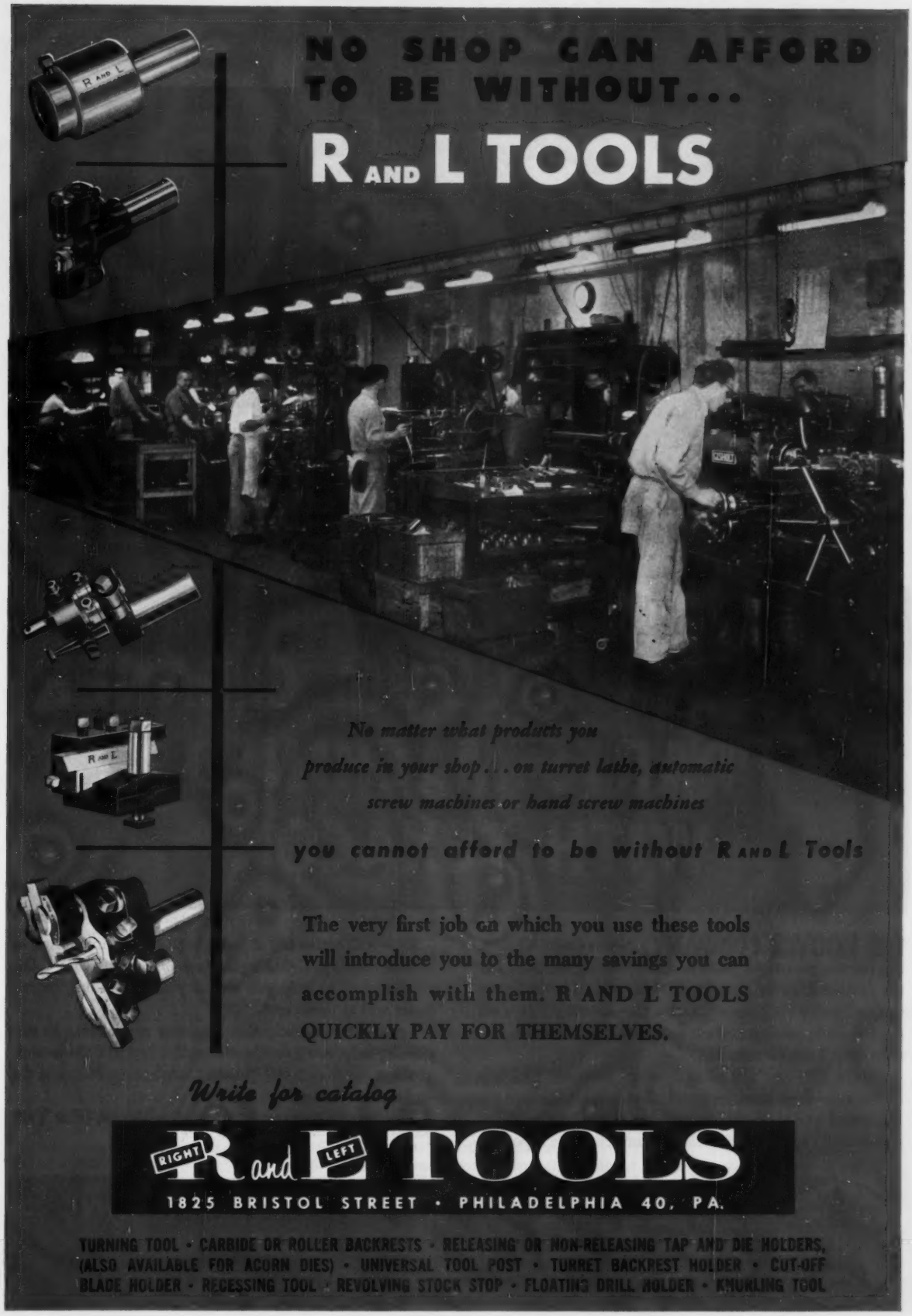
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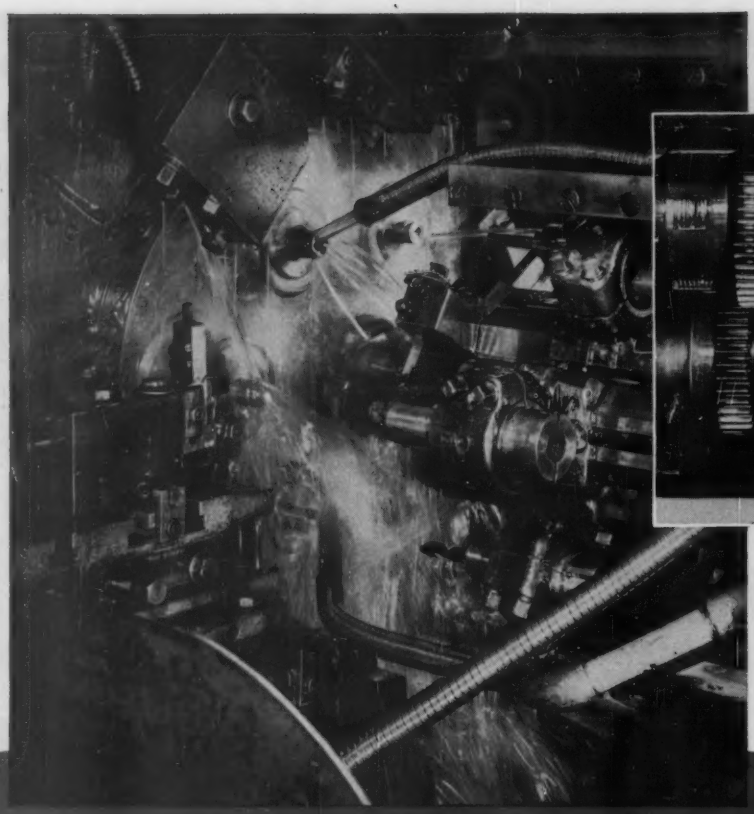
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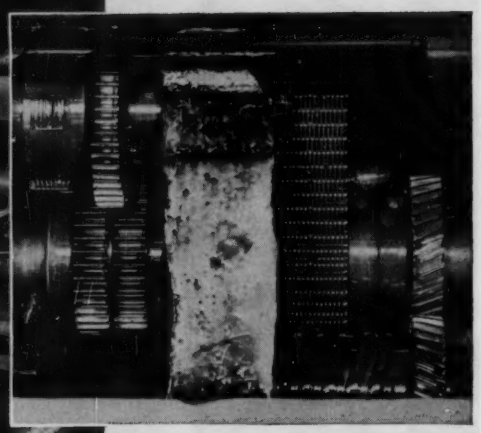
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By LORING F. OVERMAN

Defense Productive Equipment Requirements to be Reappraised

AN over-all appraisal of the present situation concerning the productive equipment of the Department of Defense appears imminent. As originally conceived in 1953, the Vance idea was to put $500,000,000 in the "side pocket" of the Department of Defense to be used when needed for the purchase of machine tools and other equipment.

Congress, wary of having such a fund lying around uncommitted, compromised by allowing the sum of $250,000,000 for use during fiscal 1954. With restraint, the Department of Defense used no part of the fund, so the House cut it out of the budget for next year. The Senate restored the item, but the Senate-House conference committee trimmed the sum to $100,000,000.

Let's Start Over

Since the original Vance program was intended to be merely a down payment on productive capacity to be developed over a period of years, the additional cutback calls for a complete re-appraisal, defense planners say. So for the next two or three months the subject will again be under study, with an entirely new machine tool program to be expected.

The approach this time is to be from need to cost, instead of vice versa. The present study starts with a list of some 1000 end items which the Military has determined it will need in "X" quantities in the event of any large-scale war.

The study will determine whether there are machines, metal, and manpower enough to meet projected requirements, including a reasonable amount of these factors for minimum civilian requirements. It is expected that many of the items will be available in adequate quantities, and that no expansion of production will be required.

ON the other hand, it is inevitable that in some spheres shortages will be certain. Attention of the planners will be directed to these bottlenecks. If shortages are considered likely because of the lack of production equipment in the plants of the makers of either end items or components, analysts will try to determine how to eliminate the bottlenecks.

The principal difficulty with a program of this type is that military needs change overnight. It is extremely difficult to anticipate requirements for items which may not even exist at the time the study is made. There are many who favor the Vance plan of maintaining a contingency fund as being more practical, flexible, and economical.

DOD Sets Machine Tool Policy

Pending completion of the new study, machine tools and production equipment for the Armed Forces will be "acquired, retained, and maintained" under new rules issued July 15 by the Department of Defense. Details are included in Defense Department Instruction 4215.1. Assistant Defense Secretary Pike explained that it is the policy of the Pentagon to retain for mobilization production "only that production equipment which would be required to equip government-owned production facilities and to augment privately owned equipment in contractors' plants for the purpose of fulfilling military production requirements."

Secretary Pike said that in determining which equipment should be maintained, the Services should base their selection on operating conditions, and upon the question of whether or not it would be feasible and practical to rehabilitate the machinery. Retention needs are to be reevaluated every two years.

Aluminum Expansion Capacity Set

An interim expansion goal to provide facilities for forging approximately 504,150,000 pounds of aluminum annually, by January 1, 1956, was announced during July by the Office of Defense Mobilization. The goal represents an increase of 108,250,000 pounds in annual capacity over that in existence on the first of this year. Government assistance will be limited to accelerated tax amortization certificates.

Washington Briefs

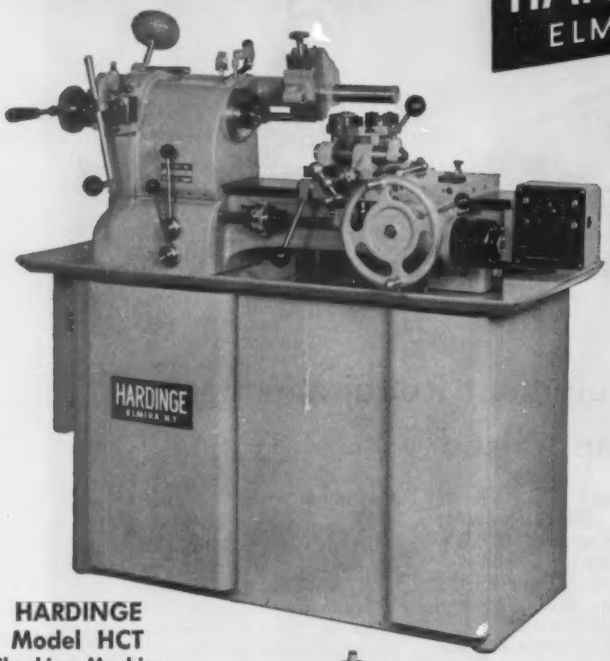
DR. William Schockley, on leave from his post as director of the Transistor Physics Department at the Bell Laboratories, Murray Hill, N. J., has been appointed Director of Research for the Weapons Systems Evaluation Group, Department of Defense. Dr. Schockley serves as deputy to the Director, Lieutenant-General Geoffrey Keyes, and as chief scientific officer of the Group. The principal function of the Group is to analyze and evaluate the comparative effectiveness and cost of present weapons with those likely to be developed in the near future.

DESPITE the easing of military pressures, Washington is continuing its efforts to see that this country does not experience another "Pearl Harbor." The latest move in this direction is the shifting of headquarters for the Federal Civil Defense Administration from Washington, D.C., to Battle Creek, Mich. About 450 of the staff of 500 will be moved. Harold B. McCoy, Deputy Administrator of the Business and Defense Services Administration, has said that there is now a complete plan for the relocation of government agencies as part of the planning for an all-out emergency.

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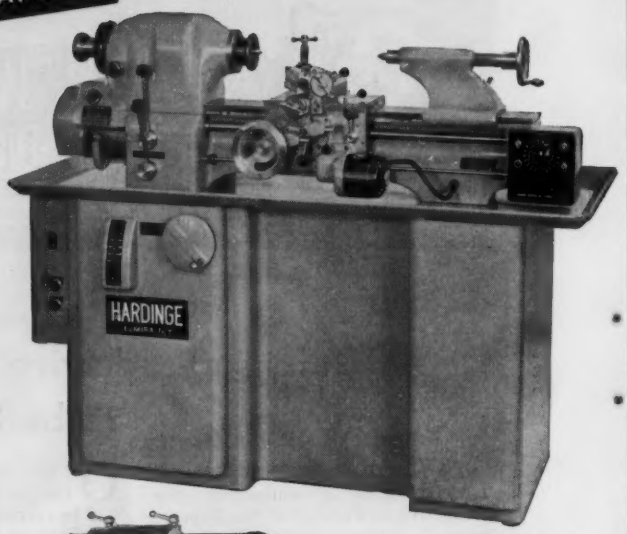


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How Many Physically Handicapped Does Your Plant Employ?

WORLD War II and the Korean incident have added heavily to the ranks of the physically handicapped in this country. Also, with our expanding population there is a constant increase in the number of persons requiring rehabilitation as the result of crippling diseases and industrial, home, and highway accidents. At the present time, there are an estimated 2,000,000 persons who are handicapped by some physical disability. The problem of finding employment for these persons who are anxious to live useful lives is little short of stupendous!

Industry should wholeheartedly endorse the National Employ the Physically Handicapped Week, which is to be observed October 3 to 9. This is the tenth year that a week has been set aside by Congress in a truly American manner and given Presidential endorsement through an appropriate proclamation. In these years, the movement for employing the physically handicapped has gained an appreciable impetus largely because persons in this category have proved their ability to perform useful service. Invariably they make loyal, conscientious employes capable of producing work on a basis profitable to the employer.

Vocational rehabilitation offices placed more than 60,000 persons in jobs during 1953, bringing the total to 500,000,000 men and women since 1943. Public employment services made 250,000 handicapped placements last year, which brought to 2,000,000 the number of such placements since 1945. This constitutes real progress and industry deserves unstinted praise for its cooperation, but there is still much to be done.

The capabilities of the physically handicapped in performing useful work have been attested to time and again. It is a common sight to see handicapped persons working at inspection benches and along production lines in our big industrial plants. A Long Island factory, however, presents a unique instance that proves the economic feasibility of employing the physically disabled.

This electronics plant is operated entirely by handicapped employes but even so competes successfully on the open market with other concerns that turn out the same kind of work. The 118 lame, halt, or blind employes were formerly unwilling burdens on relief rolls, private charities, or individual families. They are now productive and self-supporting.

This unusual enterprise was conceived by a man, himself a cripple since childhood, who had faith in the capabilities of the similarly afflicted. The business was started two years ago on a capital of only $8,000. In its two years of existence over $280,000 has been paid out in salaries. Last year, contracts were completed for $500,000 worth of military items. The faith of the business founder has been amply justified.

Approximately 160,000 persons with disabilities, including 40,000 veterans, are today registered for employment with various agencies. In addition, some 10,000 veterans who are being trained in different trades will soon be looking for jobs. How many of these potentially useful persons could your plant add to its employment roll?

Charles O. Herb

EDITOR

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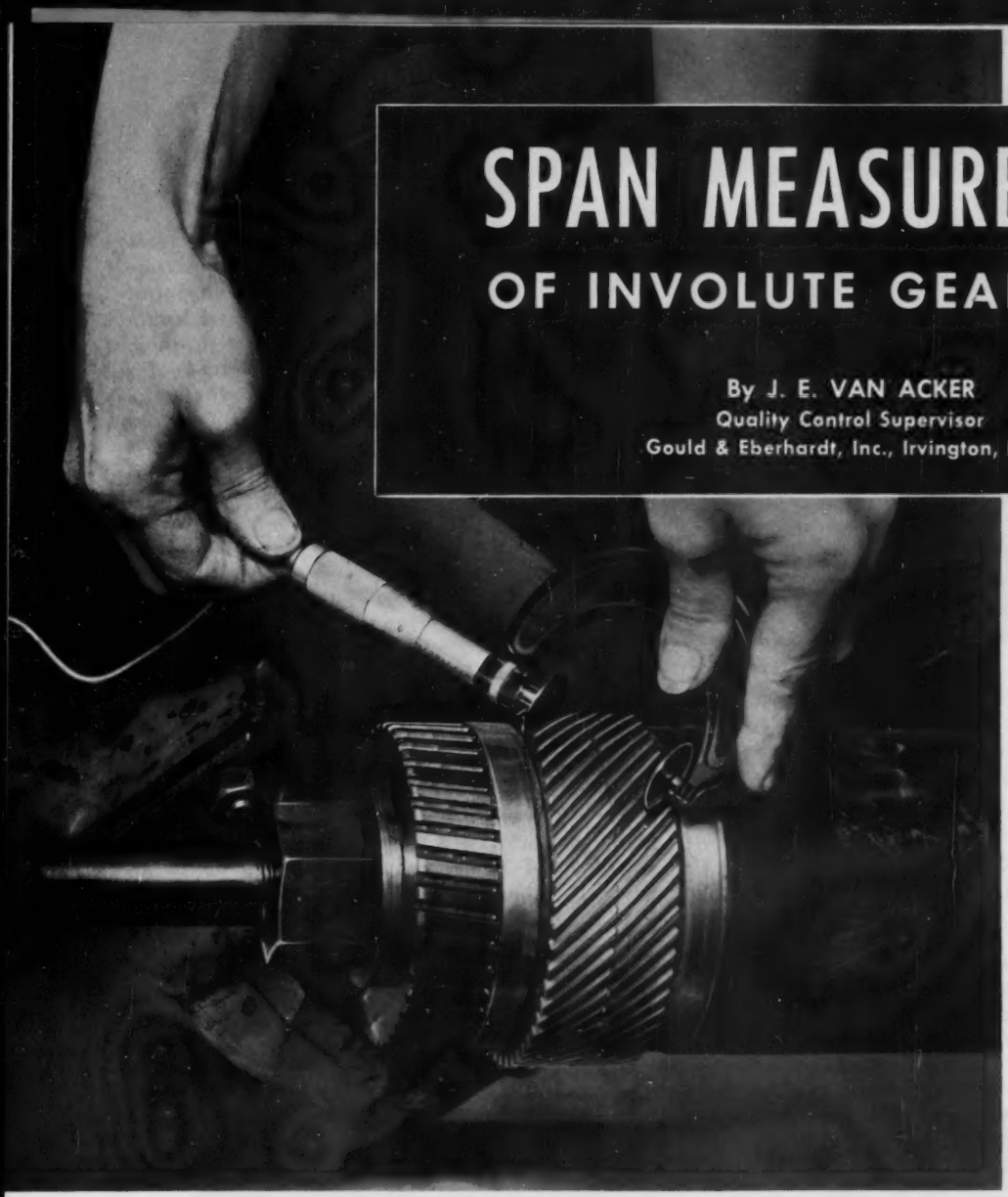
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SPAN MEASUREMENT
OF INVOLUTE GEAR TEETH

By J. E. VAN ACKER
Quality Control Supervisor
Gould & Eberhardt, Inc., Irvington, N. J.

An important paper read recently before the American Gear Manufacturers Association and presented in comprehensive form — First Installment

SPUR and helical involute gears have been measured in many different ways, but because the simplest measuring method for one type of gear may be unsuitable for another, it is commonplace to find several different pieces of equipment and various measuring methods in use in any one shop. For example, spur gears are easy to measure either over pins or by backlash when meshed with a master gear.

Helical gears can also be measured by meshing with a master gear, but the infinite number of helix angles makes this method unattractive because of the cost of the master gears. Measurement can be made over pins on helical gears having an even number of teeth, although with more difficulty than comparable measurements over spur-gear teeth. Measurements of helical gears having an odd number of teeth are extremely difficult to obtain by the use of gear pins, and little improvement is noted when measuring over properly placed balls. Gear-tooth calipers are universal in their application, but inaccuracies in their use limit them to approximate measurements only.

The span system of measurement, sometimes known as the block measurement system, in-

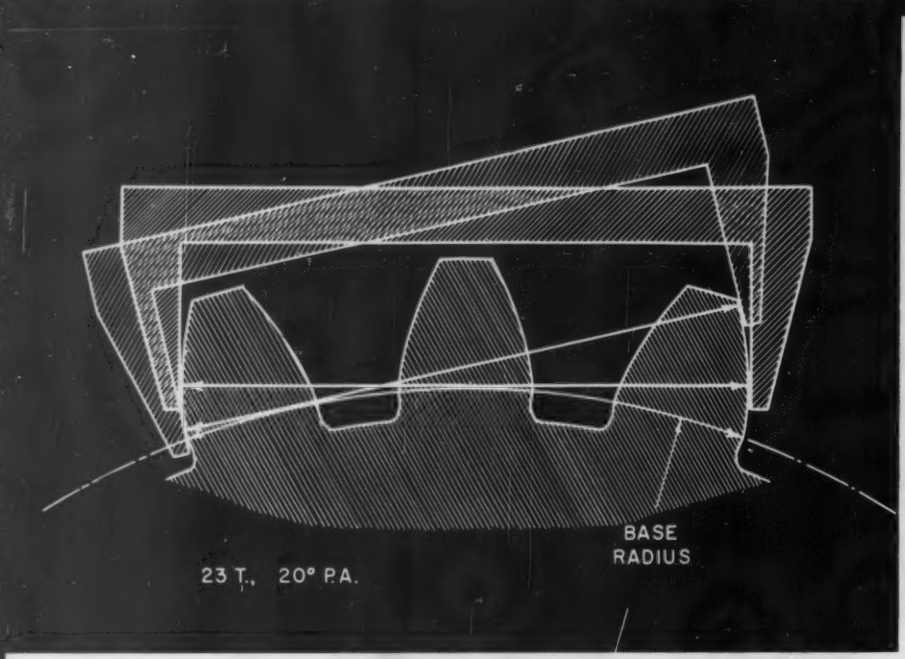
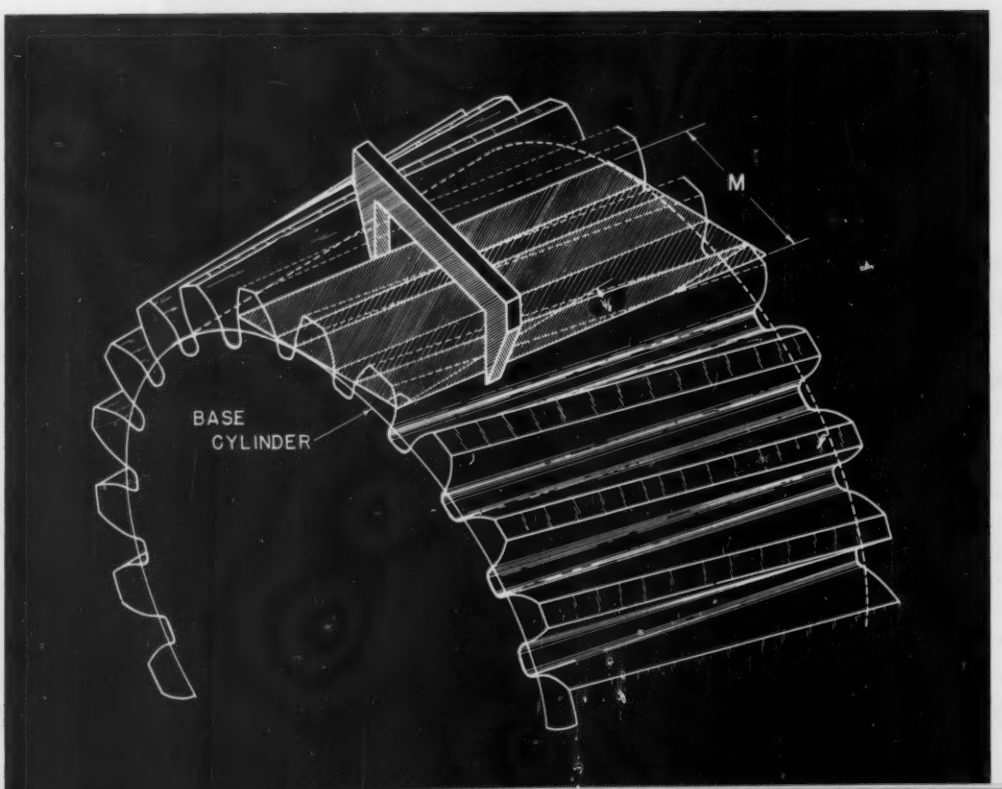


Fig. 1. Opposing tooth profiles of a pair of involute spur-gear teeth may be said to be generated by the end points of a line of fixed length rolling, without slipping, on a base circle. The distance between these opposing profiles is therefore constant, and is equal to the length of base circle arc subtended below the profiles straddled by the span of a caliper.

volves measurement over two or more teeth. It possesses universal application and a degree of accuracy that make it almost ideal. Gears can be measured while still in the machine, often while the machine is still running. This factor alone is important enough to justify its use in every gear shop. The accuracy of measurement is not affected by outside-diameter errors or run-out. No particular skill is required to obtain an accurate measurement, in contrast to the sensitive touch required with single-tooth calipers. Disagreement between inspectors and operators is virtually eliminated. No master gears, holding fixtures, pins, or balls are required. A single micrometer of 1-inch range can handle work of several inches pitch diameter range. A small

Fig. 2. Opposing tooth profiles of a pair of involute helical-gear teeth may be said to be generated by two lines, a fixed distance apart, inclined at the base helix angle in a plane that rolls, without slipping, on a base cylinder. The distance between these opposing profiles is therefore constant, and is equal to the length of base circle arc subtended below the profiles straddled by the span of a caliper.



caliper can measure a much larger gear, with resultant ease in handling.

Very little practical information concerning this system has been available for other than standard spur gears. A thorough search of the bibliography discloses a few unwieldy formulas for standard helical gears only and a complete lack of tables. Consequently, the possibility of measuring helical gears in this way is almost unknown, and micrometer calipers with suitable anvils are not in widespread use.

The span system is based on the geometric fact that any normal to an involute tooth surface will be contained in a plane tangent to the base cylinder. Consequently, two parallel caliper jaws will contact oppositely facing tooth profiles tangentially in a manner similar to that employed in gaging the diameter of a cylinder, and with a similar "feel." No edge contact is ever obtained under correct measuring conditions. The measurement is directly related to the thickness of a single tooth (or the backlash the gear contributes to the assembly), inasmuch as the measured distance is composed of a number of constant pitches plus the thickness of a single tooth.

As is illustrated in Figs. 1 and 2, the normal distance between two oppositely facing involutes or involute helicoids is equal to the developed length of the base cylinder arc segment included between the involutes in a direction normal to the base helix. The formulas for this distance utilize information normally included in gear specifications, eliminating the need for separately determining such additional elements as the base diameter and the base helix angle. However, the working pressure angle must be found in non-standard center distance operation.

The formulas that follow are applicable to all spur and helical gears of all proportions and under all conditions of operation. It should be noted that a spur gear is the limiting case of a helical gear having a 0-degree helix angle, and any helical-gear formulas requiring a trigonometric function of the helix angle are applicable to spur gears by using the trigonometric function of 0 degree. However, to eliminate the need for calculations in the case of standard spur gears, the span dimensions given in Table 1 may be used.

To obtain the transverse working pressure angle of gears operating at standard and non-standard center distances, the following formulas will be used without proof:

$$\phi_t = \arctan \frac{\tan \phi_n}{\cos \psi} \qquad (1)$$

$$\phi_k = \arccos \frac{C \cos \phi_t}{C_k} \qquad (2)$$

Definitions of Letter Symbols

M_1 = Span dimension without backlash allowance for "standard" spur and helical gears.

M_2 = Span dimension without backlash allowance for long- and short-addendum gears operating at "standard" center distances.

M_3 = Span dimension without backlash allowance for gears operating at non-standard center distance when each gear is enlarged or decreased in direct proportion to the number of teeth in each.

M_4 = Span dimension without backlash allowance for a gear operating at non-standard center distance with another gear of standard proportions.

M_P = Span dimension without backlash allowance for long-addendum pinion meshed with short-addendum gear and operating at non-standard center distance.

M_G = Span dimension without backlash allowance for short-addendum gear operating at non-standard center distance.

ΔM = Sum of span dimension corrections for gears operated at non-standard center distances and not met by any of the other conditions above.

N = Number of teeth in gear when consideration of mating gear is not required.

N_G, N_P = Number of teeth in mating gears (non-standard center distance operation).

P_n = Normal diametral pitch.

p_n = Normal circular pitch.

S = Number of pitches included within the caliper span. It is always an integer plus 0.5.

C = Standard center distance.

ΔC = Change in center distance.

C_k = Operating center distance = $C + \Delta C$.

D = Pitch diameter of gear.

ΔD = Diameter increment or decrement applied to long- and short-addendum gears.

ΔD_G, ΔD_P = Diameter increment or decrement applied to gear and pinion respectively, non-standard center distance operation.

B_t = Backlash in transverse plane, tangent to pitch circle.

B_n = Backlash normal to tooth surface, actual distance between profiles of mating gears.

ϕ_n = Normal pressure angle.

ϕ_t = Transverse pressure angle (in spur gears, $\phi_t = \phi_n$).

ϕ_k = Working transverse pressure angle of gears operating at non-standard center distance.

ψ = Helix angle at the pitch cylinder.

ψ_b = Helix angle at the base cylinder.

Number of Teeth to be Included Within the Span of the Caliper

In order to cause caliper jaws to contact the gear-tooth profiles tangentially, it is necessary to determine the number of teeth, or more correctly the number of pitches and half-pitches, which should be included within the caliper span. For practical purposes in initial computation, tooth thickness is valued as one-half of one pitch. The number of pitches which should be included within the caliper span can be found from the following formula:

$$S = \frac{N \phi_n}{180 \cos^2 \psi} \qquad (3)$$

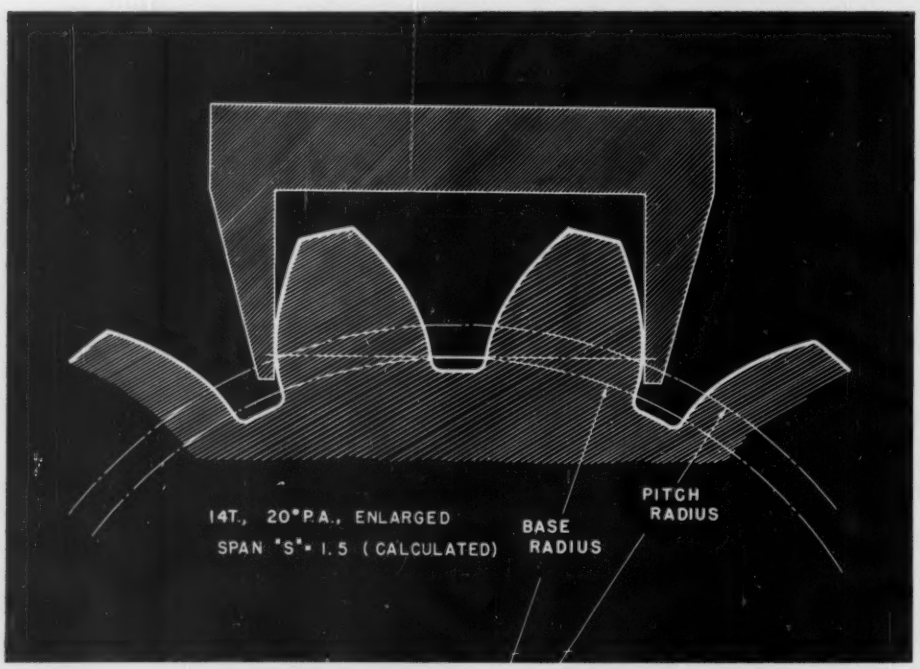
Pitch-line contact will result, as seen in Fig. 3, only in the rare case when S is exactly an integer plus one-half. Pitch-line contact is not necessary and not always desirable. The value of S must always be rounded out to an integer plus one-half before it is applied in any of the succeeding formulas, that is, 1.5, 2.5, 3.5, and so on. When the result is "rounded up," caliper contact will be made slightly above the pitch line as shown in Figs. 4 and 5, but this is considered advantageous since a better feel is obtained. "Rounding down" the result causes caliper contact to be made closer to the root fillet and the revolving range of the caliper may be unfavorably small, as seen in Fig. 4. Therefore, in any case where the result of Formula (3) is an integer plus 0.8 or more, it is better to round up the result to the next higher integer plus one-half. However, in the case of short-addendum gears, it may be necessary to round down the result of Formula (3). The value of S is seldom critical, particularly when it is 3.5 or more, and liberties may be taken in its calculation when a little experience is accumulated. A nomograph for the determination of S within acceptable limits of accuracy is given in Fig. 6. It should be stated that Formula (3) is not mathematically exact, but for practical purposes is acceptable, inasmuch as results must be rounded out to an integer plus one-half. The exact formula, if it is desired, is:

$$S = \frac{N \phi_n}{180 \cos \psi \cos \psi_b}$$

Span Dimensions for Standard Gears

The basic span dimension for standard gears meshing at standard center distances can be found from the following formula:

Fig. 3. This long addendum pinion has a calculated span measurement of 1 1/2 pitches so that pitch-line measuring contact is obtained. Since the calipers have only a short arc of rotation due to the short dedendum and root interference, the number of pitches included in the span measurement should be increased to improve measuring conditions.



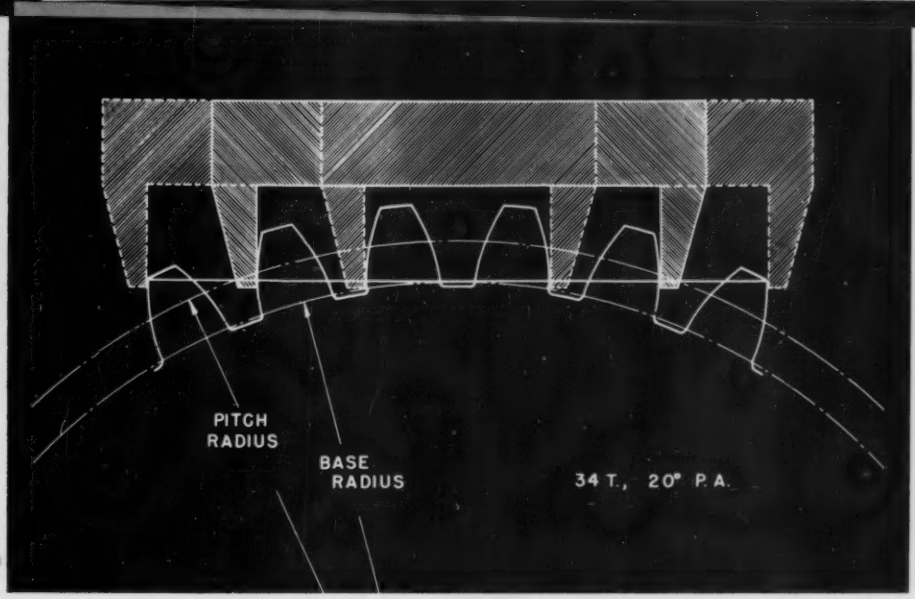


Fig. 4. Rounding up the result of Formula (3) moves the caliper contact up above the pitch line. Rounding down results in contact below the pitch line and worsens the condition illustrated in Fig. 3.

$$M_1 = \cos \phi_n \left(S p_n + \frac{N \text{ inv } \phi_t}{P_n} \right) \quad (4)$$

or, eliminating p_n,

$$M_1 = \cos \phi_n \left(\frac{\pi S + N \text{ inv } \phi_t}{P_n} \right) \quad (4a)$$

Span Dimensions for Long- and Short-Addendum Gears

In the case of long- and short-addendum gears, the change in addendum is usually designated in terms of diameter increment or decrement $\triangle D$. Where the increment $\triangle D_P$ applied to one gear equals the decrement $\triangle D_G$ applied to the mating gear, the same center distance conditions prevail as if there had been no addendum changes, and the operating (rolling) pressure angle equals the nominal pressure angle of the gears.

The span dimension of long- and short-addendum gears operating at standard center distances may be found from the following formula:

$$M_2 = \cos \phi_n \left(\frac{\pi S + N \text{ inv } \phi_t}{P_n} + \Delta D \tan \phi_n \right) \quad (5)$$

In employing this formula, it is important that the proper sign be applied to $\triangle D$, plus for a diameter increment and minus for a diameter decrement.

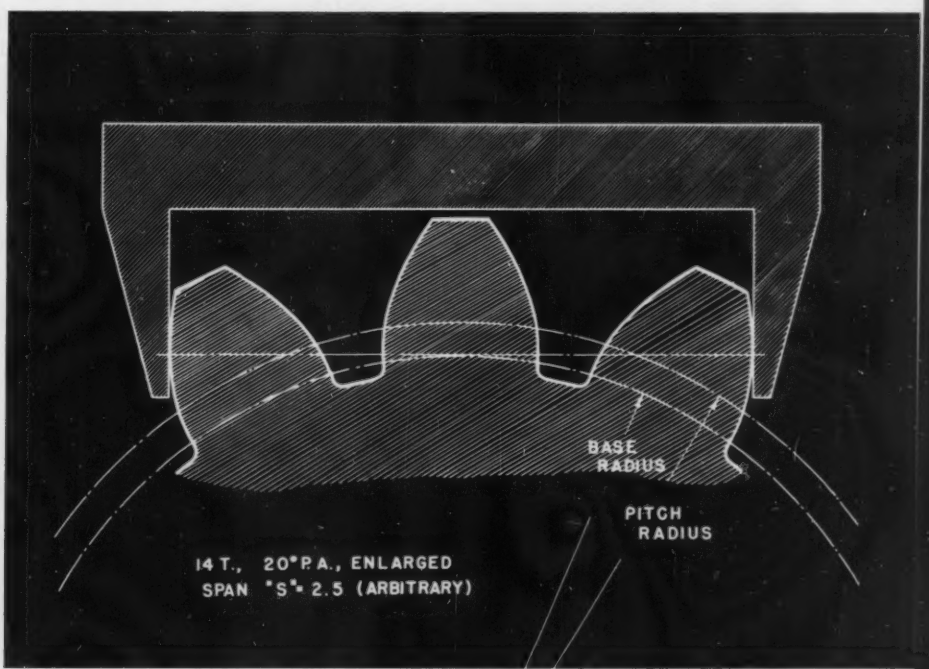


Fig. 5. Here the span of the caliper has been arbitrarily increased to 2 1/2 pitches so that measurement is made easier.

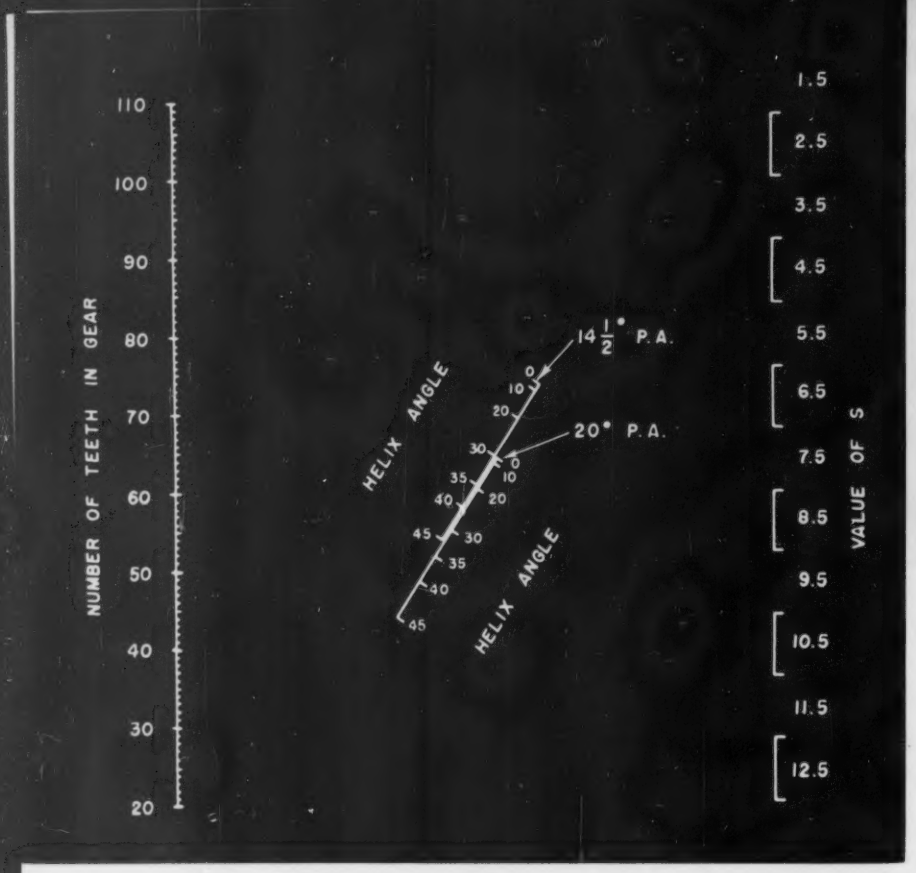


Fig. 6. This alignment chart, which is based on Formula (3), may be used to determine the number of pitches to be included in the caliper span. A straight line through the number of teeth on the left, and the helix angle in the center, gives the (S) value at the right.

Span Dimensions for Non-Standard Center Distance Operation

At times, required gear ratio and center distance combinations cannot be obtained with standard pitches, and helix angles may be limited so that addendum increments or decrements must be applied to the mating gears which are then operated at non-standard center distances. When the center distance is not standard, the operating pressure angle of the gears is not the same as the nominal transverse pressure angle of the basic rack. Under this condition, mating gear-tooth profiles may have zero backlash with respect to the basic rack even though each of the mating gears will contact the basic rack at different points.

This displacement of contact points, together with the curvature of the tooth profiles, causes backlash between the tooth profiles of mating gears, as shown in Fig. 7. As a result, tooth-size measurements will not correspond with actual measured backlash unless the dimensions have been computed from a formula which corrects for the backlash effect of non-standard center distance operation.

Mating Gears Proportionately Modified—When both mating gears are enlarged or decreased in direct proportion to the number of teeth in each, the span dimension may be found from the following formula:

$$M_3 = \cos \phi_n \left(\frac{\pi S + N \text{ inv } \phi k}{P_n} \right) \qquad (6)$$

Only One Gear Modified—Non-standard center distance mating gears cannot always be enlarged or decreased in proportion to the number of teeth in each of the pair. In a three-gear train, for example, one enlarged gear may be meshed at increased center distance with a second gear which is already meshed with a third gear at standard center distance. Obviously, the center gear cannot be enlarged because of the dual requirements. If only one gear in the train has been enlarged or decreased by a diameter increment $\triangle D$ (which equals $2\triangle C$), the span dimension of that one gear can be found from the following formula:

$$M_4 = \cos \phi_n \left(\frac{\pi S + (N_G + N_P) \text{ inv } \phi k - N_P \text{ inv } \phi i}{P_n} \right) \qquad (7)$$

In this formula, N_G represents the gear that is modified, and N_P its unmodified mate.

Long- and Short-Addendum Gears Further Modified for Non-Standard Center Distance Operation—In some cases, a pinion may be enlarged more or less than the mating gear is decreased, and the pair may then be run at non-standard center distances to improve the performance of the gear set. In this case, it is customary to also increase the thickness of the pinion by the

amount of the backlash effect resulting from the non-standard center distance operation. The formula for the *gear only* in this case is basically the same as Formula (5) and is repeated here in its modified form:

$$M_G = \cos \phi_n \left(\frac{\pi S + N_G \text{ inv } \phi_t}{P_n} + \Delta D_G \tan \phi_n \right) \quad (5a)$$

The formula for the *pinion only* is as follows:

$$M_P = \cos \phi_n \left(\frac{\pi S + (N_G + N_P) \text{ inv } \phi_k - N_G \text{ inv } \phi_t}{P_n} - \Delta D_G \tan \phi_n \right) \quad (8)$$

In applying Formula (8), it should be noted that, since $\triangle D_G$ is the diameter *decrement* of the mating gear, its value is negative. Accordingly, a negative value of $\triangle D_G$ should be used when substituting values in the formula.

Uncommon Applications of Non-Standard Center Distance Gears—In some unusual applications of long, continuous gear trains and in some types of non-metallic gearing where substantially all-addendum tooth proportions are used, the compounded effects of long-and-short addendums and non-standard center distances complicate the design problem, and the shop is often required to work initially on cut-and-try basis.

Span dimensions may be calculated in these special cases. The basic span dimension for each gear is obtained from Formula (5a) and a correction increment $\triangle M$ is then added to correct for the backlash effect. The correction is computed from the formula:

$$\Delta M = \cos \phi_n \left[\frac{(N_G + N_P) (\text{inv } \phi_k - \text{inv } \phi_t)}{P_n} - 2\Delta C \tan \phi_n \right] \quad (9)$$

$\triangle M$ is always a positive quantity and is the sum of the correction factors for both of the mating gears. It may be applied entirely to only one gear as the case may require, or it may be divided in any manner between the gears according to the discretion of the gear engineer.

Enlarged Gears Meshing With a Rack—Gears meshing with racks always operate at the transverse pressure angle of the rack, and backlash, as shown in Fig. 7, is impossible. Therefore, either enlarged or reduced gears meshing with a rack are treated the same as any long- or short-addendum gear operating at a standard center distance, and Formula (5a) is applicable.

Helical Gears Operating at Crossed Axes—Helical gears operated at crossed axes are not subject to backlash, as shown in Fig. 7. The geometric basis for this statement is complex and its proof is beyond the scope of this paper. Since the backlash due to non-standard center distance operation is not a factor, the span dimension of each gear can be found from either Formula (4a) or (5a), depending on whether the gear is standard or modified.

Backlash

If the gear actually measures smaller than the calculated size, the difference between the calculated size and the actual measurement is the nor-

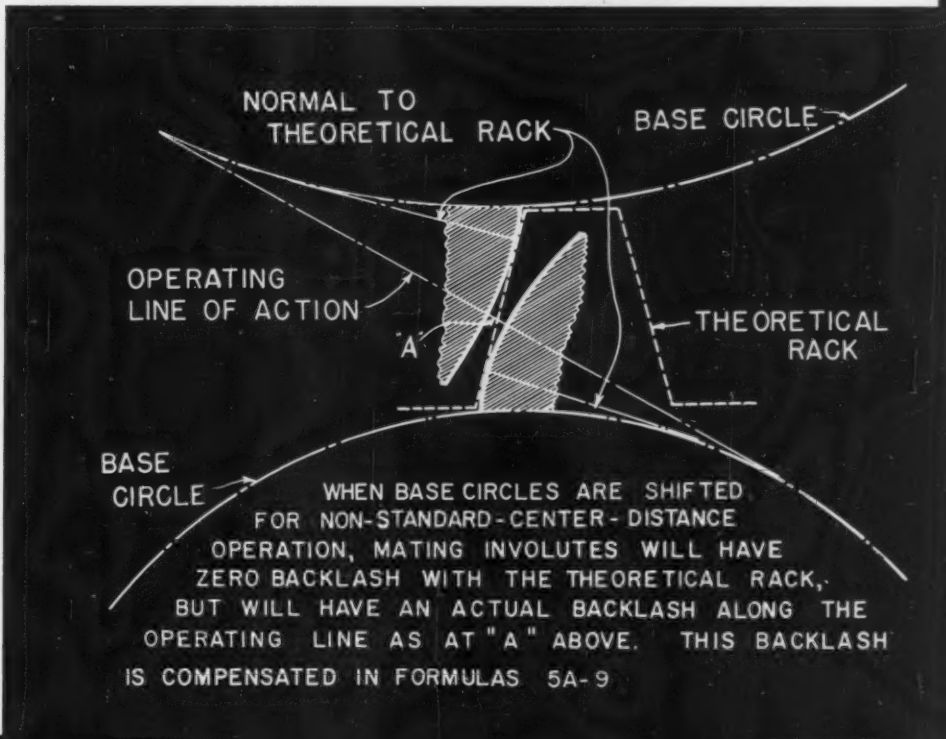


Fig. 7. When base circles are shifted for non-standard center-distance operation, mating involutes will have zero backlash with a theoretical rack. With respect to each other, however, they will have backlash (A), as shown. This backlash is compensated for in Formulas (6), (7), (5a), (8), and (9).

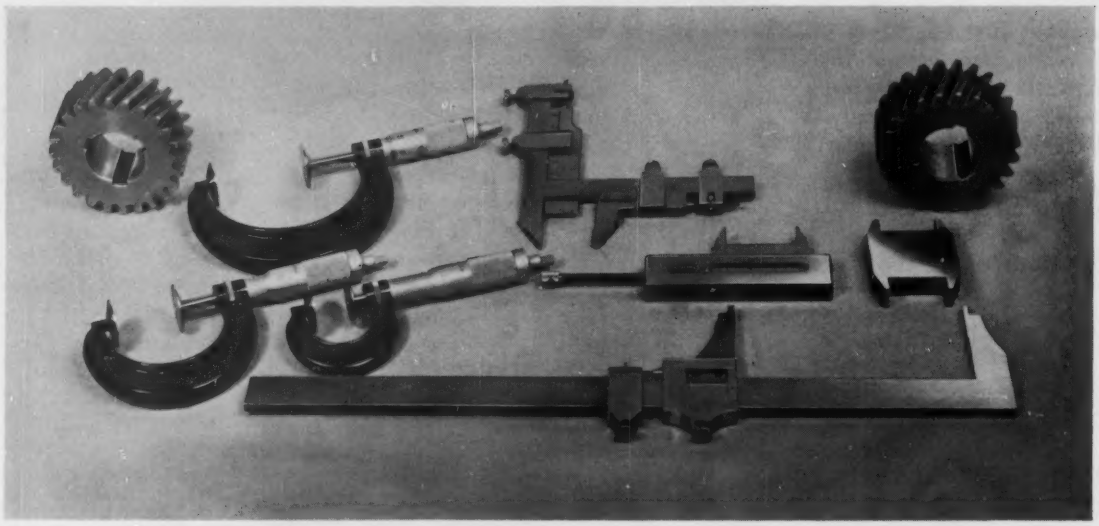
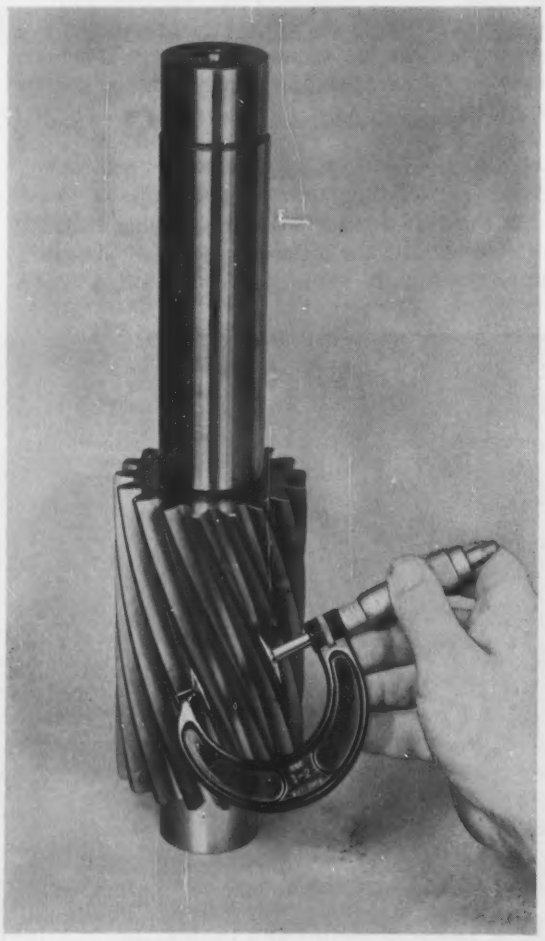


Fig. 8. Instruments adapted to span measurement include a tooth vernier caliper with the addendum blade retracted, a vernier caliper, a set of jaws used in conjunction with gage-blocks, and micrometers.



mal base backlash which that one gear would contribute to the mesh. Normal base backlash is the actual clearance between meshing gear teeth and may be considered as the amount of oil space between mating teeth. For most practical purposes, it is highly desirable that backlash be measured in this fashion as it is not necessary to increase backlash allowances for gears having high helix angles. However, when backlash must be controlled in a long gear train, as in some instrument or computer designs, it is necessary to convert normal base backlash to transverse pitch-line backlash.

To convert normal base backlash to transverse pitch-line backlash, use the following formula:

$$B_t = \frac{B_n}{\cos \phi_n \cos \psi} \qquad (10)$$

Instrumentation for Span Measurements

Suitable calipers should be used to measure external gears, splines, or worms. Some of these are shown in Fig. 8. Extremely coarse pitches may be measured with a vernier caliper; most gears can be measured with a gear-tooth vernier caliper in good condition with the addendum blade retracted. Best results are obtained with a micrometer having extended anvil faces which can reach between gear teeth, as seen in the heading illustration and in Fig. 9.

Fig. 9. Close-up view of a span measurement micrometer in use

Table 1. Span Dimensions for 1 Diametral Pitch Spur Gears of 14 1/2- and 20-Degree Pressure Angle*

Number of Teeth in Gear	Span Dimension, Inches	Number of Teeth in Gear	Span Dimension, Inches	Number of Teeth in Gear	Span Dimension, Inches	Number of Teeth in Gear	Span Dimension, Inches
14 1/2-DEGREE PRESSURE ANGLE							
9	4.6106	41	10.8654	73	20.1618	105	26.4166
10	4.6160	42	10.8708	74	20.1672	106	26.4220
11	4.6213	43	10.8762	75	20.1725	107	26.4274
12	4.6267	44	10.8815	76	20.1779	108	26.4327
13	4.6321	45	10.8869	77	20.1833	109	26.4381
14	4.6374	46	10.8923	78	20.1886	110	29.4850
15	4.6428	47	10.8976	79	20.1940	111	29.4904
16	4.6482	48	13.9445	80	20.1994	112	29.4957
17	4.6535	49	13.9499	81	20.2047	113	29.5011
18	4.6589	50	13.9553	82	20.2101	114	29.5065
19	4.6643	51	13.9606	83	20.2155	115	29.5118
20	4.6697	52	13.9660	84	20.2208	116	29.5172
21	4.6750	53	13.9714	85	23.2677	117	29.5226
22	4.6804	54	13.9767	86	23.2731	118	29.5279
23	7.7273	55	13.9821	87	23.2785	119	29.5333
24	7.7327	56	13.9875	88	23.2838	120	29.5387
25	7.7380	57	13.9929	89	23.2892	121	29.5440
26	7.7434	58	13.9982	90	23.2946	122	32.5909
27	7.7488	59	14.0036	91	23.2999	123	32.5963
28	7.7541	60	17.0505	92	23.3053	124	32.6017
29	7.7595	61	17.0558	93	23.3107	125	32.6070
30	7.7649	62	17.0612	94	23.3161	126	32.6124
31	7.7702	63	17.0666	95	23.3214	127	32.6178
32	7.7756	64	17.0720	96	23.3268	128	32.6231
33	7.7810	65	17.0773	97	23.3322	129	32.6285
34	7.7863	66	17.0827	98	26.3790	130	32.6339
35	10.8332	67	17.0881	99	26.3844	131	32.6393
36	10.8386	68	17.0934	100	26.3898	132	32.6446
37	10.8440	69	17.0988	101	26.3952	133	32.6500
38	10.8493	70	17.1042	102	26.4005	134	32.6554
39	10.8547	71	17.1095	103	26.4059		
40	10.8601	72	17.1149	104	26.4113		
20-DEGREE PRESSURE ANGLE							
7	4.5262	39	13.8308	71	26.0875	103	35.3921
8	4.5402	40	13.8448	72	26.1015	104	35.4061
9	4.5542	41	13.8588	73	26.1155	105	35.4201
10	4.5683	42	13.8728	74	26.1295	106	35.4341
11	4.5823	43	13.8868	75	26.1435	107	38.4002
12	4.5963	44	16.8530	76	26.1575	108	38.4142
13	4.6103	45	16.8670	77	26.1715	109	38.4282
14	4.6243	46	16.8810	78	26.1855	110	38.4423
15	4.6383	47	16.8950	79	26.1996	111	38.4563
16	4.6523	48	16.9090	80	29.1657	112	38.4703
17	7.6184	49	16.9230	81	29.1797	113	38.4843
18	7.6324	50	16.9370	82	29.1937	114	38.4983
19	7.6464	51	16.9510	83	29.2077	115	38.5123
20	7.6604	52	16.9650	84	29.2217	116	41.4784
21	7.6744	53	19.9311	85	29.2357	117	41.4924
22	7.6885	54	19.9452	86	29.2497	118	41.5064
23	7.7025	55	19.9592	87	29.2637	119	41.5204
24	7.7165	56	19.9732	88	29.2777	120	41.5344
25	7.7305	57	19.9872	89	32.2439	121	41.5484
26	10.6966	58	20.0012	90	32.2579	122	41.5624
27	10.7106	59	20.0152	91	32.2719	123	41.5765
28	10.7246	60	20.0292	92	32.2859	124	41.5905
29	10.7386	61	20.0432	93	32.2999	125	44.5566
30	10.7526	62	23.0093	94	32.3139	126	44.5706
31	10.7666	63	23.0233	95	32.3279	127	44.5846
32	10.7806	64	23.0373	96	32.3419	128	44.5986
33	10.7946	65	23.0513	97	32.3559	129	44.6126
34	10.8086	66	23.0654	98	35.3221	130	44.6266
35	13.7748	67	23.0794	99	35.3361	131	44.6406
36	13.7888	68	23.0934	100	35.3501	132	44.6546
37	13.8028	69	23.1074	101	35.3641	133	44.6686
38	13.8168	70	23.1214	102	35.3781		

*Span dimensions given are for standard center distance spur gears of 1 diametral pitch without allowance for backlash. For other diametral pitches, divide tabulated span dimensions by the diametral pitch. Backlash may be provided by reducing the span dimensions as required.

For long- and short-addendum spur gears operating at standard center distance, span dimensions are determined as above and then altered by adding or subtracting $\triangle M$. ($\triangle M = \triangle D \sin \phi_n$). $\triangle M$ is added when $\triangle D$ is a diameter increment and subtracted when $\triangle D$ is a diameter decrement.

For high-production inspection, double-end limit snap gages can be made up and used, as shown in Fig. 10. Dial calipers are also commercially available. Dial calipers must have at least one plane anvil to be suitable for helical gear measurement. A cylinder-and-sphere anvil dial caliper is acceptable for spur gears only. Special instrumentation, not yet commercially available, is necessary to check internal gears, but coarse-pitch internal spur gears may be measured by employing the internal anvils of an ordinary vernier caliper.

Limitations of the Span Measuring Method

The span method of measuring helical gears cannot be used if a high helix angle and a narrow face width combine to throw the caliper anvils off the gear teeth. This may be overcome to some extent by on-the-machine measurements when gears are stacked, as seen in the heading illustration. In this way, the combined width of the stacked gears is usually sufficient to permit measurement. In general, narrow face widths in a helical gear require that the span of the caliper be reduced to include fewer teeth, but there is a lower limit beyond which root-fillet interference will prevent proper caliper contact. This is best determined by trial in those cases where such a situation arises.

Helical-lead errors can affect the span measurement, but it has been observed that lead errors of sufficient magnitude to affect the measurement would be very much beyond a reasonable tolerance for lead error.

Total index errors are readily noticeable because there will be differences in measurements around the gear. They are a function of the hobber, gear-cutting machine, or gear-shaper cutter, and any measurable difference around the gear is an indication that repairs on the machine are in order.

Table 2. Number of Teeth Included in Span Dimensions Given in Table 1

Number of Teeth in Gear		Number of Teeth Included in Span
$\phi_n = 14\ 1/2$ Degrees	$\phi_n = 20$ Degrees	
9 to 22	7 to 16	2
23 to 34	17 to 25	3
35 to 47	26 to 34	4
48 to 59	35 to 43	5
60 to 72	44 to 52	6
73 to 84	53 to 61	7
85 to 97	62 to 70	8
98 to 109	71 to 79	9
110 to 121	80 to 88	10
122 to 134	89 to 97	11
. . . .	98 to 106	12
. . . .	107 to 115	13
. . . .	116 to 124	14
. . . .	125 to 133	15

Profile errors also affect the span measurement, but the same may be said of any other measuring method. The span method has the advantage that the measuring calipers may be rocked up and down the tooth profile, and an indication of the correctness of the tooth profile may be had. Profile error limits are usually so small that they can be easily absorbed in the backlash limits.

Specially arranged tables of trigonometric and involute functions of the transverse pressure angle ϕ_t are useful in computing span dimensions of helical gears. In a second installment of this article to appear in October MACHINERY, such tables, along with step-by-step solutions of typical gear problems, will be presented. In addition, a series of modified formulas for Fellows and Sykes transverse diametral helical gears will be given. (Copyrighted jointly by J. E. Van Acker and THE INDUSTRIAL PRESS.)

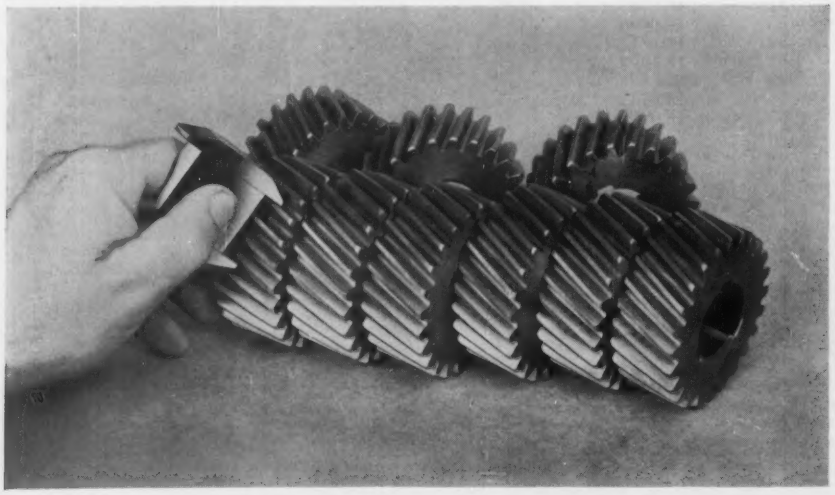


Fig. 10. Snap gages with GO and NOT GO limits, as shown in use here, can be either made up or purchased.

Loading Devices Speed Gear-Shaving Production



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CONSISTENT reductions in the time required for rotary gear shaving have been achieved over the last five years through improved shaving methods and machines. The shorter machine cycle created the problem of providing faster means of loading the gears into the machines.

For example, a typical shaving machine can finish all the teeth on a twelve-tooth gear, 1 inch in diameter and having a 1-inch face width, in eleven seconds. However, manual loading and unloading functions would require approximately the same amount of time. Therefore, the machine will produce parts at a production rate far less than its optimum capacity. For this reason, much time and effort have been put into the design and development of loading devices that reduce or eliminate expensive operator time, and enable shaving machines to finish gears much faster than has been previously possible.

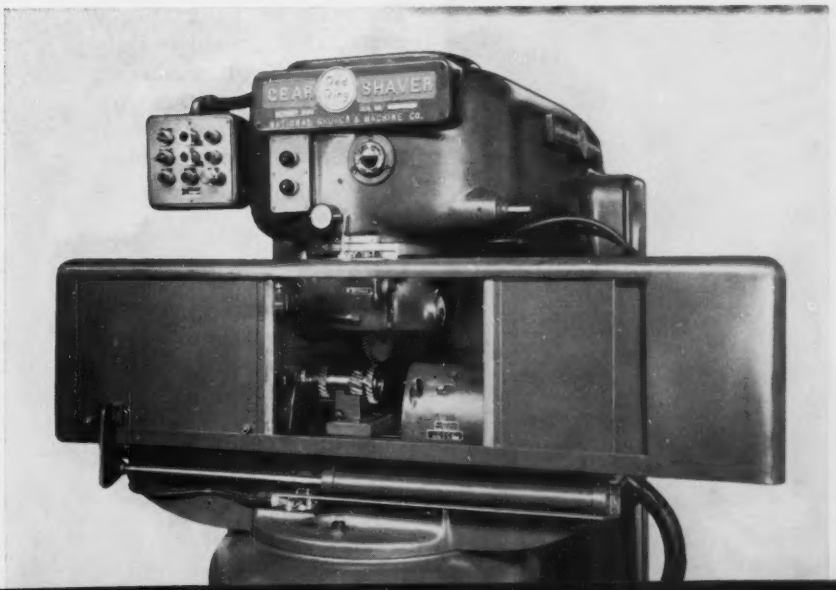
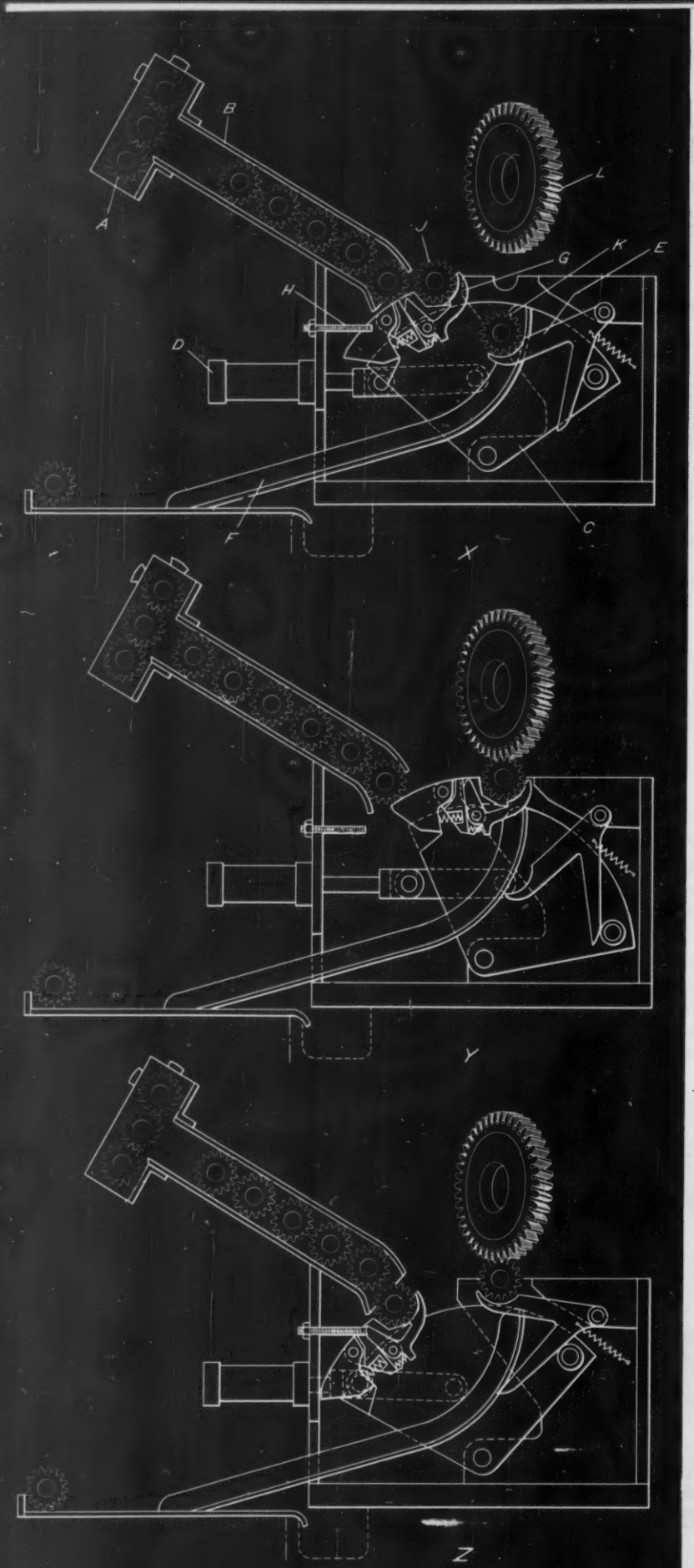


Fig. 1. Typical semi-automatic loading set-up for shaving automotive transmission cluster gears. An air cylinder controls operation of the splash door.



Loaders for rotary shaving machines can be either semi-automatic or fully automatic. Semi-automatic loading is naturally faster than manual loading, but the rate of production depends on the operator. In a semi-automatic operation on one type of gear-shaving machine, the operator places a gear in loose mesh with the cutter, while resting it on a work-locator that positions the gear approximately, and then presses the cycle-start button. The balance of the operation is automatic.

In a typical semi-automatic cycle, an air-operated tailstock locates and clamps the gear, a splash door that is also air-operated closes, the coolant begins to flow, and the machine goes through the shaving cycle. Then, the coolant automatically shuts off, the splash door opens, and the tailstock retracts, leaving the shaved gear resting on the approximate locator for the operator to remove. Convenient push-buttons are provided for hand operation when required during set-up.

Fully automatic loaders have magazine feeds and the operator merely keeps the magazine full, and removes finished parts from a tray at the front of the machine. The gears are automatically gaged, fed, positioned in mesh with the cutter, shaved, and unloaded on the tray. Production requirements and the design of the work-piece determine which type of

Fig. 2. Sequence of functions of a rocker type loader. In view X (top), gear (J) is being transferred into shaving position, and finished gear (K) is being unloaded into discharge chute (F).

fully automatic loader should be used or whether a semi-automatic type of loader would be a more economical selection.

Loader Motion Analysis

Seven separate motions are required with manual loading to complete the shaving of a gear when the operator does not have to feed the gear into tight mesh with the feed wheel. These motions are:

1. Placing the gear in mesh
2. Advancing and locking the tailstock
3. Closing the splash guard door
4. Pressing the starting button
5. Opening the splash guard door
6. Retracting the tailstock
7. Removing the shaved gear

With semi-automatic loading, the seven motions can be reduced to three:

1. Placing the gear in mesh while resting it on an approximate locator
2. Pressing the starting button
3. Removing the shaved gear

When entirely automatic loaders are installed, the machines run continuously and the motions are reduced to two, neither of which affects the cycle:

1. Keeping the magazine filled
2. Removing finished gears

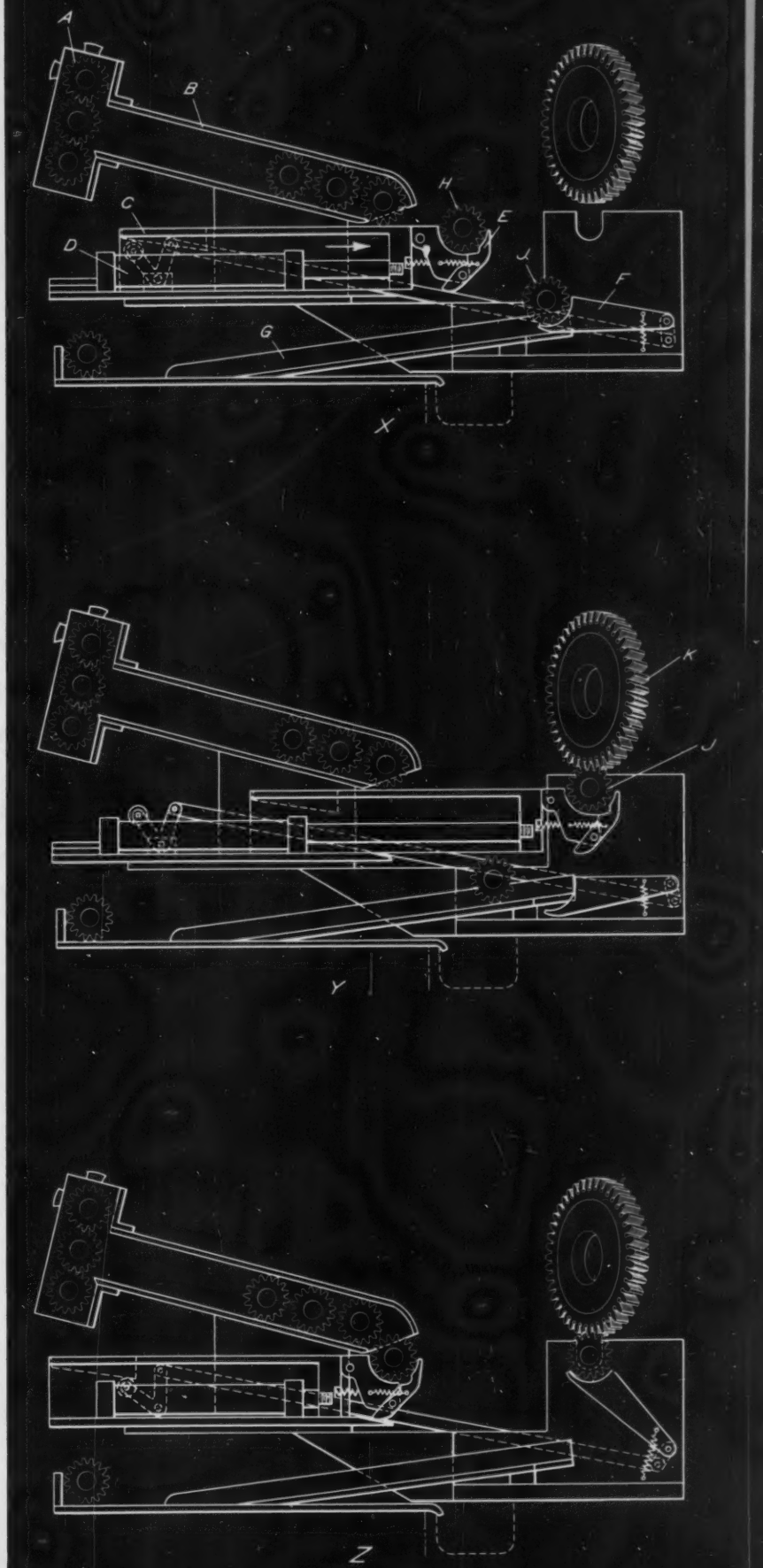


Fig. 3. Sequence of functions of a slide type loader mechanism. The air-operated transfer slide (C) carries a spring-actuated loading finger (E) for gripping the gear during transfer to shaving position.



Fig. 4. Slide type loader designed particularly for handling long shafts and unsymmetrical gears. This loader handles 180 automotive automatic transmission gears per hour.

When Semi-Automatic Loaders Should be Specified

Semi-automatic loading set-ups, such as that seen in Fig. 1, should be specified when the number of work-pieces to be produced or the labor rates do not justify the installation of fully automatic loaders. The semi-automatic loaders are more versatile because a variety of gears can be shaved on a single machine by changing only the approximate work-locator and integral plug or center tools.

Semi-automatic loaders are faster and result in less operator fatigue than manual loading methods. Also, there is less cost and maintenance than with fully automatic types. One operator can usually attend two machines equipped with semi-automatic loaders, except in cases where the cycle time on one or both machines is exceptionally short.

The Economies of Fully Automatic Loaders for Gear-Shaving Machines

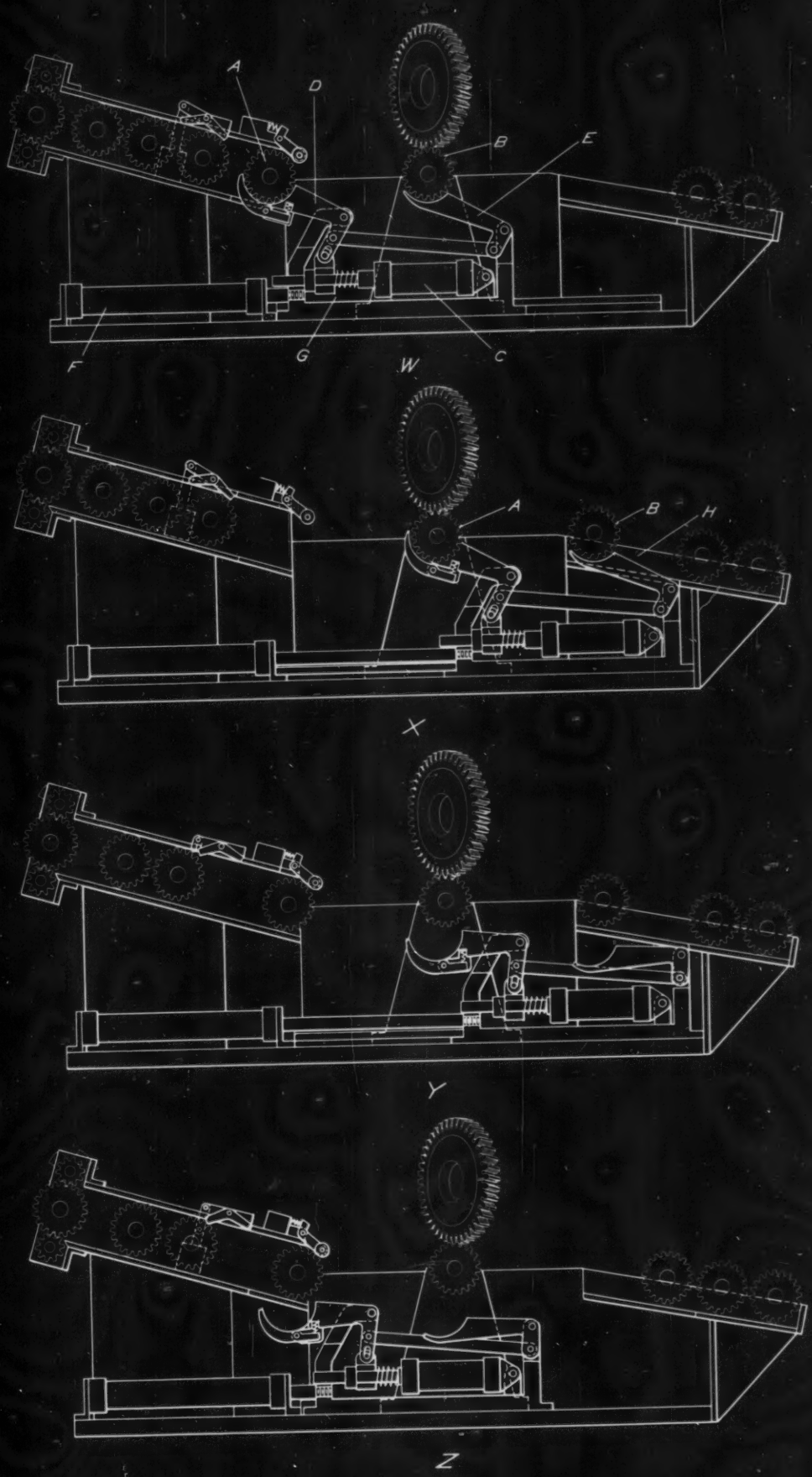
Compared with manual loading methods, fully automatic loaders—such as the one shown in the heading illustration—provide more production per machine. After set-up, the operator just keeps the magazine full and removes finished gears. There is no "down" time between shaving operations on successive gears. When batteries of shaving machines are automatically loaded, signal lights can be employed to indicate when any machine requires parts. Maximum safety is provided because the operator's hands are never near the cutter.

From the economy standpoint, fully automatic loaders cut labor costs because they require fewer operators. Also, capital investment and floor space requirements are reduced since fewer shaving machines are needed to attain a specified production rate.

The quality of gears shaved on machines equipped with automatic loaders is consistently high because of uniform automatic clamping. Also, cutter life is generally increased because of integral gaging elements which insure control of the amount of stock removed.

Automatic loaders are economically feasible for high-production jobs in which each individual shaving machine is tooled for only one part. Production quantities should be sufficient to permit one operator to attend to two or more machines. However, an automatic loader on an operation requiring only a single shaving machine gives the operator free time to perform inspection or burring. Thus, it may be economi-

Fig. 5. (Opposite) In this typical straight-line loader, air cylinder (C), which actuates fingers (D) and (E), is mounted on a slide (G) reciprocated by air cylinder (F).


A
D
B
E
F
G
W
C
A
B
H
X
Y
Z

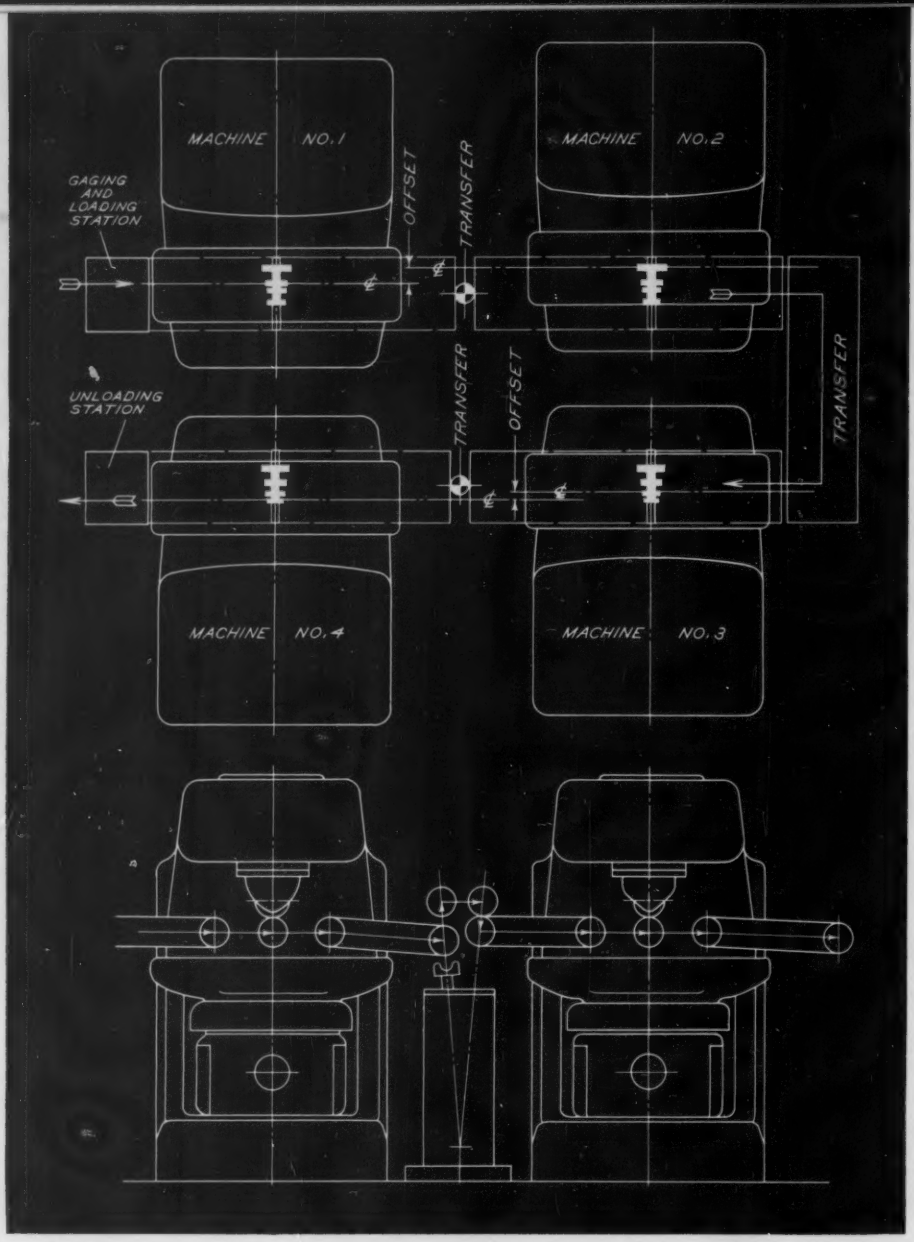


Fig. 6. Lay-out showing how standard shaving machines can be equipped with straight-line loaders to provide an efficient set-up for cluster gears.

cal to have one operator for a single shaving machine even when it is equipped with an automatic loader.

The following example gives a comparison between the time required to produce a twelve-tooth gear, 1 inch in diameter and having a 1-inch face width, by manual and fully automatic loading methods:

Shaving time .....11 seconds
Manual loading and
unloading .....10 seconds
21 seconds, giving a production of 137 parts per hour at 80 per cent efficiency

Shaving time .....11 seconds
Fully automatic loading and unloading . 2 seconds, maximum
13 seconds, giving a production of 277 parts per hour at 80 per cent efficiency

Thus, the automatic loading method provides more than double the production with a labor saving of at least 50 per cent.

Fully automatic loaders for gear-shaving machines must meet several design requirements. They must (1) gage the gear tooth size before shaving to avoid cutter damage; (2) deliver the gear to the rotary shaving cutter properly ori-

ented for meshing; (3) be safety interlocked with the machine cycle; (4) be of simple trouble-free design; (5) unload the part in optimum handling location; (6) be adaptable to standard shaving machines; (7) include standard parts that will reduce costs; (8) handle a wide variety of gear sizes and types; (9) have accessible selector buttons to operate each function separately for set-up purposes; (10) handle the gears without nicking or marking; and (11) be fast-operating with a minimum of movements.

Types of Automatic Loaders

Three general types of automatic loading devices that meet the specified design requirements are:

1. Rocker type, for small gears up to approximately 2 inches in diameter.
2. Slide type, for medium-sized gears and shafts, or parts requiring a steadyrest
3. Straight-line type, for larger gears, including cluster gears. This type is also used where transfer directly from one machine to another is desired.

Almost a hundred loaders of these types are now being used in gear production lines in a wide variety of metal-working plants. The loaders are handling external gears having pitch diameters from 0.850 to 5.8 inches; diametrical pitches from 9 1/4 to 18; helix angles from 14 to 45 degrees; and face widths from 5/8 inch to 2 1/2 inches. The gears can have straight bores, integral centers, or integral shafts.

Rocker Type Loader

The rocker type loader shown in Fig. 2 is believed to be the first type that was actually used in production. Automation of this type is somewhat unusual inasmuch as the teeth of the gear must mesh positively each time with the teeth of the shaving cutter.

The loader itself has three principal parts, or functions: (1) A sizing gage *A* and storage magazine *B;* (2) a pivoting, sector-shaped transfer plate *C* actuated by an air cylinder *D;* and (3) an unloading finger *E* and discharge chute *F*. Transfer plate *C* is equipped with a spring-operated loading finger *G* which contacts an adjustable stop-screw *H* during the shaving operation.

View X shows the relative positions of the parts as one gear *J* is being transferred into shaving position, and finished gear *K* is being unloaded into the discharge chute; view Y illustrates gear *J* in meshed position for shaving; and view Z shows the parts during shaving. The shaving cutter is indicated at *L*.

A mechanical hook-up is provided on the rocker type loading mechanism whereby the forward movement of the air cylinder piston simultaneously releases the finished part and delivers a new part to the cutter. These functions are accomplished very rapidly, and without danger of the mechanism getting out of time. Electric controls are used merely for safety interlocks, and to illuminate signal lamps that indicate when the cycle has started or stopped, and when the headstock and tailstock are clamped or unclamped. Convenient push-buttons are provided for hand operation of all loader functions during set-up and trial runs.

Slide Type Loader

Slide type loaders, Figs. 3 and 4, have all the essential features of the rocker type, but differ from them in one respect. The transfer unit consists of a horizontal slide instead of the pivoting sector-shaped plate used with rocker type loaders. This is done for economy and because of design limitations. It permits larger gears to be handled on the same size machine.

The typical slide type loader, shown diagrammatically in Fig. 3, is equipped with a sizing gage *A* and storage magazine *B*. Transfer slide *C*, operated by an air cylinder *D*, has a spring-actuated loading finger *E* for gripping the gear while it is being transferred into shaving position. A cam, lever, and spring-operated unloading finger *F* lower shaved gears into the discharge chute *G*.

View X shows the relative positions of the loading mechanism parts as gear *H* is being transferred into shaving position, and finished gear *J* is being lowered into the discharge chute. View Y shows gear *J* being placed in mesh with shaving cutter *K*, and view Z, the relative position of the parts during the shaving cycle.

Straight-Line Loader

Straight-line loading devices are a natural development to satisfy the demand for automation of still larger gears. In this case, the design objective has been to use a standard machine and not sacrifice its capacity to shave large gears because of the loader. Such loaders permit using the full vertical open height capacity of the machine.

In straight-line loaders, the cutter, loading mechanism, and gears to be shaved are located in a plane 90 degrees from that employed with rocker type and slide type loaders. All of the basic features of the other loaders are retained, including speed and a minimum of lost machine time. One movement of the transfer slide simul-

taneously removes a finished gear and delivers the next gear to be shaved.

The sequence of functions performed by a typical straight-line loading mechanism is shown diagrammatically in Fig. 5. In view W—which represents the completion of the shaving cycle—gear *A* is about to be transferred into cutting position and finished gear *B* is about to be unloaded. Two air cylinders are employed in this set-up, cylinder *C* actuating both loading finger *D* and unloading finger *E*, and cylinder *F* traversing slide *G*.

View X shows gear *A* being placed in mesh with the shaving cutter, and gear *B* being unloaded into discharge chute *H*. As the shaving cycle begins (view Y), the loading and unloading fingers are automatically retracted, and then returned to their starting positions (view Z), ready to begin the next cycle.

Straight-line loaders are ideally adapted to the shaving of cluster gears, where high production requires the shaving of each gear in the cluster on an individual machine. The cluster gears can be fed from machine to machine in straight-line flow by a transfer device. Such an efficient gear-shaving production set-up is illustrated in Fig. 6. The straight-line loader is also ideally suited for automated production lines where straight-line flow in connection with automatic transfer equipment is a basic requirement.

Pressed Sleeve Eliminates Hand Splicing

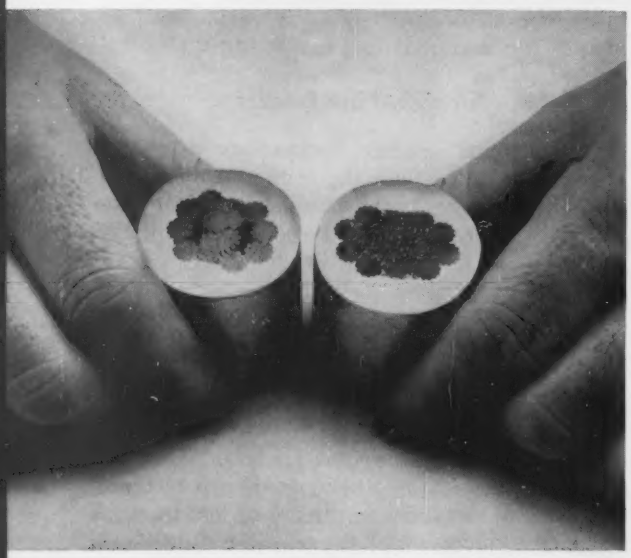
SUBSTANTIAL savings in time are made possible by a new wire rope pressing system that eliminates hand splicing. Using the new system, a worker can make as many as twenty or thirty splices in an hour, as compared to six or seven conventional splices per hour for a skilled worker using hand methods. The new pressing system, announced recently by the Jones & Laughlin Steel Corporation, employs an aluminum-alloy clamp or sleeve that is squeezed around the wire rope in a special 300-ton hydraulic press.

The device, which is called JalKlamp, is used as a mechanical method of splicing eyes, with or without thimbles, in the ends of wire rope. This "splice" gives 100 per cent of the breaking strength of the wire rope itself. Also, there is a big saving in the length of wire rope needed to make the splice. The saving amounts to about 85 per cent of the rope needed for hand splice.

The sleeve consists of a piece of metal tubing, oval in cross-section, with a place for the two ends of the wire rope cable to be clamped together. The sleeve material is a special non-corrosive aluminum alloy that combines great strength with the ability to flow cold under pressure at room temperature.

To make a splice, the wire rope is first measured, cut, and inserted in the clamp. Then the clamp is crimped or squeezed around the wire. A pressed water-tight joint is formed without damage to the individual wires. The clamp metal actually flows into the space between the wires in the strands and between the strands themselves. The clamp becomes a part of the rope. The new splicing method can be used with a full range of wire rope diameters, up to and including 2 inches.

Special 300-ton capacity, motor-operated hydraulic presses have been leased to apply this type of terminal to wire rope up to and including 3/4 inch in diameter. With this unique press, any type of wire rope with any type of center, including fiber, can be squeezed with 100 per cent efficiency. A complete set of dies for different rope diameters goes with each press. Jones & Laughlin is distributing the clamps and presses in the United States. The clamps are made in Sweden, and the dies and special hydraulic presses are also of Swedish origin.



Cut-away sections of a JalKlamp terminal splice. The sleeve material is a special non-corrosive aluminum alloy that is squeezed around the wire rope in a special press. Sample at left has a fiber core, while that at the right has an independent wire rope center.



Bolt Cold-Heading and Inspection at International Harvester

Coils of hot-drawn rod are pickled before and after spheroidizing. Ninety per cent of the output is cold-headed, chiefly in automatic Boltmakers

By J. P. LEHNING
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West Pullman Works, International Harvester Co., Chicago, Ill.

ONE of the largest captive operations for producing headed parts such as bolts, screws, and rivets, 1/4 to 3/4 inch in diameter, is operated at the West Pullman Works of the International Harvester Co., Chicago, Ill. The output from this department is furnished to many other International Harvester plants on a regularly scheduled basis.

Approximately 90 per cent of the tonnage produced is headed cold. Much of this work is performed on National Machinery Boltmakers that not only do the heading but also trim the heads, point the ends, and thread the bodies when necessary. Threads are generated by roll type dies. These machines are used for both short and long runs. Conventional headers are employed for jobs not adapted to the automatic machines but they do not trim, point, or thread.

Some of the twenty Boltmakers in this plant are show in the heading illustration. Hogue wire drawers size the rods as they are drawn into the heading machines, thereby assuring a good finish, free of scale and rust. This finish also promotes a uniformly high quality with minimum wear on the heading and threading dies. The drawing operation permits stocking fewer sizes of rods. Rods that are to be used with the conventional headers are drawn before being brought to the machine.

The first operation on the coils of stock is pickling, which is followed by washing. When spheroidizing is specified, this operation is performed in batch type Loftus furnaces, after which the coils are again pickled and washed. There is also a continuous annealing furnace that is used when required.

Coils in the heat-treating and pickling department are handled by overhead cranes equipped with hairpin carriers. Racks used to hold the coils in the heat-treating furnaces are generally transferred by crane to an upright positioner. The positioner is tilted 90 degrees to transfer the load to a truck pintle for transporting to the heading machines.



Fig. 1. Three reels of coiled stock are mounted on a turntable to make it easier for header operator to guide the heavier, more rigid stock into the machine.

In the heading department, the coils are transferred to vertical reels or holders. Overhead cranes are used to place the reels over vertical pivot shafts adjacent to the machines. These shafts allow the reels to turn freely as the stock is fed into the machines. Two fixed pivots are installed at most of the heading machines so that one holder can be used while the empty one is being replaced. This enables the heading equipment to operate almost continuously.

Coiled rod of large diameter is relatively rigid and hard to straighten, thereby making threading difficult. At headers where such stock is used, vertical pivot shafts are not fixed but are mounted in sets of three on turntables, as shown in Fig. 1. This makes it easier for the operator to move the coil into position for feeding. Pivot shafts for extra coils may be loaded with reels without disturbing the reel being used.

After the required operations are completed, the parts are discharged either directly into tote barrels or into a washer and then into barrels. Each Boltmaker has its own washer. An overhead track crane is used to transport the barrels to the next phase of production which may require the use of a secondary machine or a con-



Fig. 2. Conveyor on which special fixtures are attached for moving parts through a Magnaglo machine, where they are checked for flaws.



Fig. 3. Flaws are revealed by ultraviolet light in this booth (normally closed) as treated parts are advanced and rotated under the watchful eye of an inspector.

tinuous heat-treating furnace. If heat-treatment is necessary, the tote barrels are dumped into a hopper from which the parts are fed automatically through the furnace, quenching bath, and washer—then once again into barrels.

Certain parts, which are earmarked for critical use, are checked for flaws with a Magnaglo machine. This machine incorporates a conveyor having fixtures on which the parts are set by hand, Fig. 2. As the parts advance, they are magnetized and then sprayed with a fluid containing fine magnetic fluorescent particles.

The conveyor carries the parts into a booth where they are examined while being rotated slowly under an ultraviolet light, as seen in Fig. 3. There, glowing of accumulated particles reveals the flaws in imperfect parts. Such parts are then discarded. Acceptable parts continue along the conveyor and are demagnetized.

When the headed products are ready for shipment, they are conveyed in barrels on the overhead track crane to the shipping line shown in Fig. 4 and dumped into hoppers. From the hoppers they are fed by vibrators into cartons on Yale weighing machines. Each carton then receives its standard weight of parts.



Fig. 4. An overhead crane transports tote barrels containing the parts to hoppers in shipping room where they are fed into cartons and weighed automatically.



Brass Wheels Grind Carbides

By ARTHUR A. MERRY, Chief
and
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ELECTRICAL discharge grinding may soon emerge as a common means for obtaining many contour shapes in carbide cutters. The process has the advantages of simplicity, speed, and economy. This article relates the experience of the Pratt & Whitney Aircraft Division of the United Aircraft Corporation, East Hartford, Conn., in pioneering the establishment of an electrical discharge grinding department as an addition to its tool-room.

Briefly, the method involves an intermittent, high-frequency arc discharge to erode the material. The work, submerged in a dielectric coolant, is connected to the positive terminal of a power supply unit. The electrode, or tool, is made of free-machining yellow brass, and is connected to the negative terminal. Metal is eroded by the arc discharge across a minute gap between the tool and the work. A servomechanism feeds the table, maintaining a constant gap size during the operation.

In using the method for its original purpose—which was to produce intricate die contours in hard metals—the equipment resembles a drill press. The electrode, supported in the drill head, descends (without revolving) into the work, which is supported in an insulated basin on the machine table. In cross-section, the electrode is identical in shape with that of the desired die contour.

As adapted to the grinding of carbide cutters at Pratt & Whitney Aircraft, the method employs a cutter and tool grinder as its basic piece of equipment. Here, the electrode is a brass wheel, the periphery of which is machined to the reverse of the desired cutter form. The table stroke is under the control of a servomechanism, and it is possible to complete the form entirely in a single pass. Actually, both a roughing and a finishing pass are usually taken.

In the heading illustration is a view in the company's electrical discharge grinding department, showing a Brown & Sharpe No. 10-N cutter and tool grinder and an Elox electronic power pack. The brass wheel is mounted directly on the spindle of the grinder and operates partly immersed in a large tank molded to the machine table. The table itself is insulated from the rest of the machine.

Wheel speed has no close bearing on the speed of metal removal, and is purposely held down in order to reduce vibration and avoid splashing the dielectric coolant contained in the tank. A Boston "Ratiomotor" (seen behind the wheel) delivers spindle speeds from 50 to 500 R.P.M. Since the wheel also is eroded during the operation, the primary purpose of rotating the wheel is to maintain its concentricity.

In the view looking down into the tank, Fig. 1, it can be seen how the shape of the wheel periphery has been reproduced in the completed work-piece gripped in the vise. The tank, made of reinforced fiber glass and epoxy resin, is molded to the edges of the swivel table of the machine. The top of the table serves as the bottom of the tank, so that the T-slot in the table can be used for bolting down the vise.

Reprocessed transformer oil is used as the dielectric coolant. During the grinding operation, the work is completely submerged in the coolant, which is circulated from a reservoir located in base of the machine. Itself an insulator, the coolant serves to build up electrical resistance so that energy storage is at its peak for the arc discharge. Another important function of the coolant is to flush away the eroded particles from the wheel and the work.

The mechanism feeding the table is mounted behind the longitudinal-travel handwheel. This detail is shown enlarged in Fig. 2. A 12-inch diameter, 16-pitch spur gear is keyed to the handwheel shaft, being driven by a 13/16-inch diameter pinion of an aircraft direct-current servo motor. With the motor running at a speed of 4 1/2 to 9 R.P.M., the table travels at a rate of approximately 4 1/2 inches per minute. On low-volume metal removal, a table travel of 10 or more inches per minute can be employed to allow the servo motor to operate at maximum efficiency.

The Elox power unit is wired to the insulated machine table, supplying "plus" current to the work. A ground wire attached to a commutator, which is spring-loaded against the rear face of the brass wheel, shunts the negative charge back to the control panel of the unit when the wheel is properly gapped with the work. In this way, the amount of arcing through the spindle bearings is minimized. Directed through the panel, the servo motor automatically controls the size of gap—0.00015 to 0.0002 inch—being sensitized by a relayed signal caused by a variation in the length of the arc.

Thus, the table travel is automatically regulated to suit the amount of metal removal, which is constant for various materials regardless of the surface area being machined. For a commercial finish of 60 micro-inches r.m.s., the rates of metal removal for carbide and hard steel generally average 0.0035 and 0.0038 cubic inch per minute, respectively.

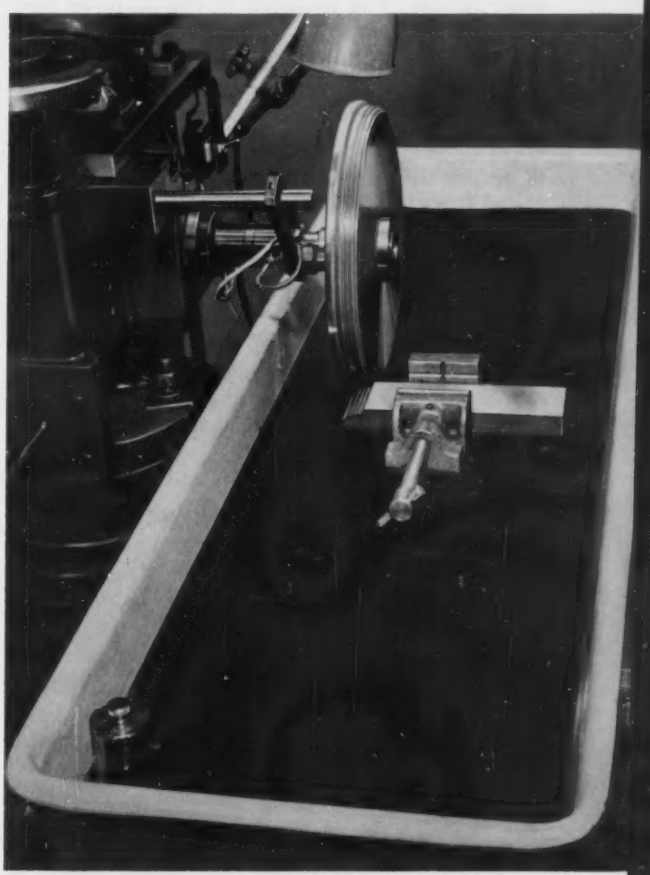


Fig. 1. The table of the grinder is converted into an insulated tank for a dielectric coolant. Behind the wheel can be seen the commutator through which the circuit to the wheel is completed.

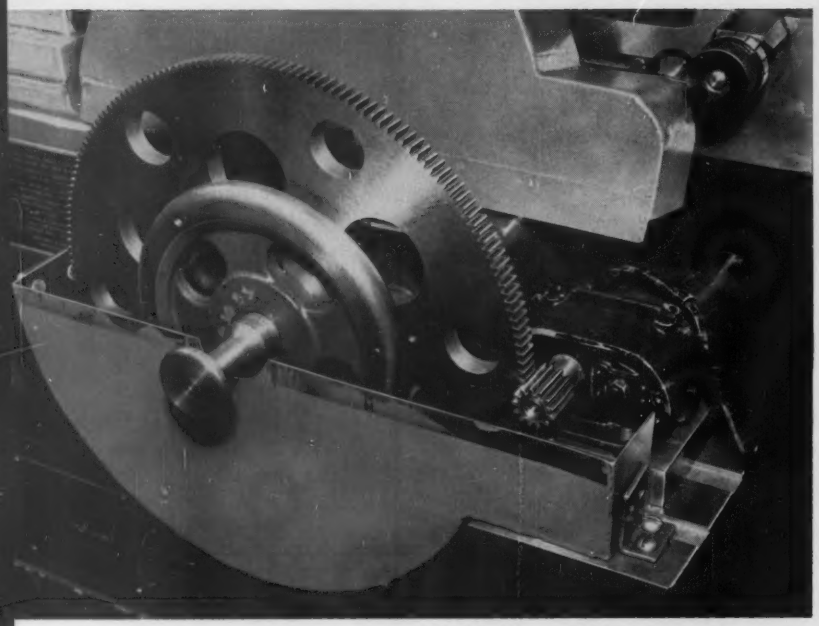


Fig. 2. Geared to the longitudinal-travel handwheel shaft, an aircraft servo motor maintains a constant gap size.

There is no theoretical limit to the time required to remove material by this process, and no known limit to the amount of electrical energy that can be discharged by the electrode and the work. Material is removed in the form of tiny hollow spheres, 1/2 to 10 microns in diameter. The circuit is designed so as to pre-select a controlled energy composed of three factors—volts, amperes, and time (frequency). By raising or lowering the energy, various finishes can be obtained, with the removal time being proportionate to one of the factors.

High on the list of advantages claimed for electrical discharge grinding is the economy of the method. Approximately 2,000,000 carbide cutters must be sharpened each year at Pratt & Whitney Aircraft. The brass wheel electrodes are insignificant in cost ($4 to $8).

Shaping the periphery of a brass wheel is a simple lathe job. A master of the desired form, made of tool steel or carbide, such as in Fig. 3, is fed into the wheel and shapes it in a plunge cut. The wheel, in turn, reproduces the form in the work, as in Fig. 4, without loss of fidelity.

Since the erosion rate of the electrode is very low, variation in the contour is at a minimum. Radii can be held sharp to 0.001 to 0.002 inch, without the burrs or heat checks attendant to contact friction grinding. There can be no "loading" of the brass wheel, and steel and tungsten carbide can be ground simultaneously. And with the absence of mechanical pressure by the wheel on the work, holding fixtures and devices need not be elaborate.

Inspection of carbide cutters shows that those ground by arc discharge have a better edge than those ground with a diamond wheel, but not lapped. Profilometer readings of the cut surface of arc-ground cutters show a finish of 20 to 25 micro-inches r.m.s. What is more, the quality of the finish is maintained from piece to piece. Particles separate from the surface cleanly, without the wiping effect of the diamond wheel. Fig. 5 is a 20X magnification of a typical surface. A Profilometer reading of 24 micro-inches r.m.s. was obtained. By regulating the high-frequency current to the work, it is possible to obtain finishes of 2 to 5 micro-inches r.m.s.

Intricate cutter forms incorporating male and female radii and sharp corners can be completed in a single pass, although it is preferable to



Fig. 3. This master dresses the wheel periphery in a plunge cut. Masters are generally made of tool steel or carbide.

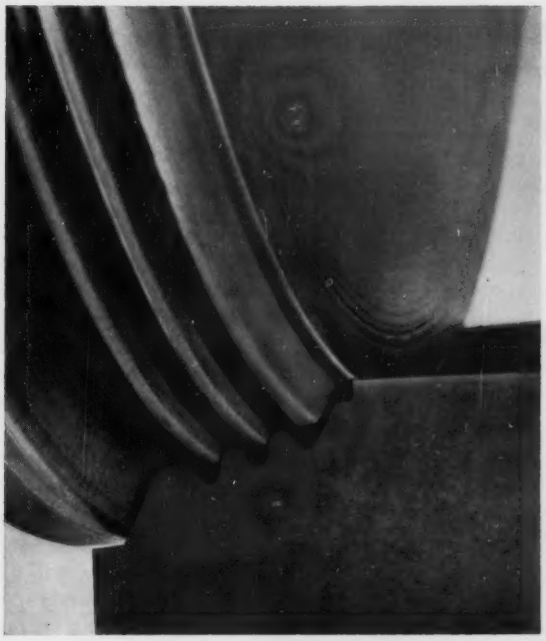


Fig. 4. It is possible to reproduce the complete contour in the work in a single roughing and a single finishing pass.

rough-machine at a lower current frequency for fast metal removal, and then to finish-machine in a separate pass at the frequency level required for the finish desired. Once the machine is set, it requires no further attention from the operator, and automatically shuts down when the pass is completed. If at any time during the pass the electrode makes contact with the work, the servomechanism retracts the table until the proper gap is re-established.

Like any new development, there have been drawbacks in building an efficient machine. Modifications are now being made to increase rigidity, improve the filtering of the dielectric coolant, and raise the rate of metal removal. Since the wheel is effective only when the gap size is maintained between 0.00015 and 0.0002 inch, spindle rigidity is of the utmost importance.

Currently, the machine is being equipped with an Ex-Cell-O heavy-duty ball-bearing spindle capable of rigidly holding wheels up to 16 inches in diameter. An attachment on the spindle will support a tool bit for dressing the wheel, thus eliminating the need for chucking the wheel in a lathe. As for the filtering, which is considered inadequate at present, a Fuller's earth filter is soon to replace the paper one now in use.

A further important advantage of the method is that no compromise need be made in the design of a cutter or in the part produced by the cutter simply to avoid some difficulty in obtaining or preserving the form in the wheel periphery. The present "Christmas tree" shape of turbine blades for jet engines, for example, is an engineering modification dictated by the difficulty encountered in dressing a diamond wheel. By the same token, the use of carbides for intricate forming blocks, chasers, dies for thread-rolling machines, and broach inserts should undoubtedly increase.

* * *

Glass Comparator Charts Rapidly Produced by New Method

A new precision method of quickly producing glass charts for use on optical comparators has been developed by the Template Reproduction & Engineering Co., Philadelphia, Pa. This method utilizes a direct contact reflex photographic system. A valuable feature of the process is that the same negative used for making the comparator chart can be used to make facsimile reproductions on sensitized metal from which enlarged size templates can be made.

A lay-out of the object is first made, usually ten or twenty times the size, on specially prepared coated stock. This white coated stock has the same drafting characteristics as fine drawing paper, and lay-outs may be made in pencil or ink, or by scribing. An exact, direct-contact photo-reflex negative reproduction (on glass) of the lay-out is then made, which is subsequently reproduced photographically on specially sensitized plate glass to make the comparator chart. Once the negative has been made any desired number of duplicate comparator charts or reproductions on metal can be made from the same negative.

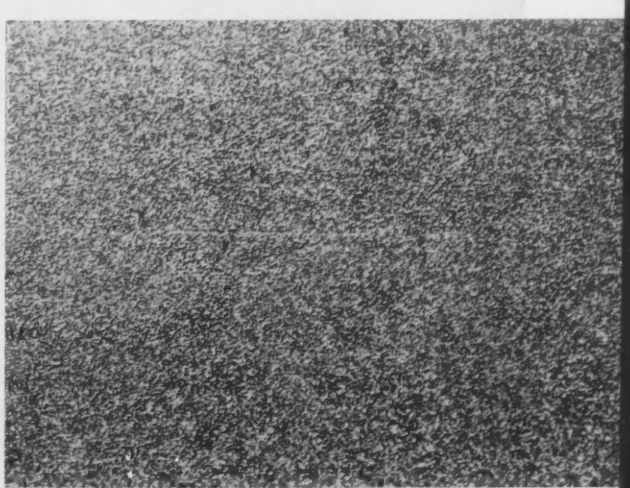


Fig. 5. This 20X photomicrograph shows a typical finish obtained by electrical discharge grinding.

14,000-Ton Press Produces Big Extrusions

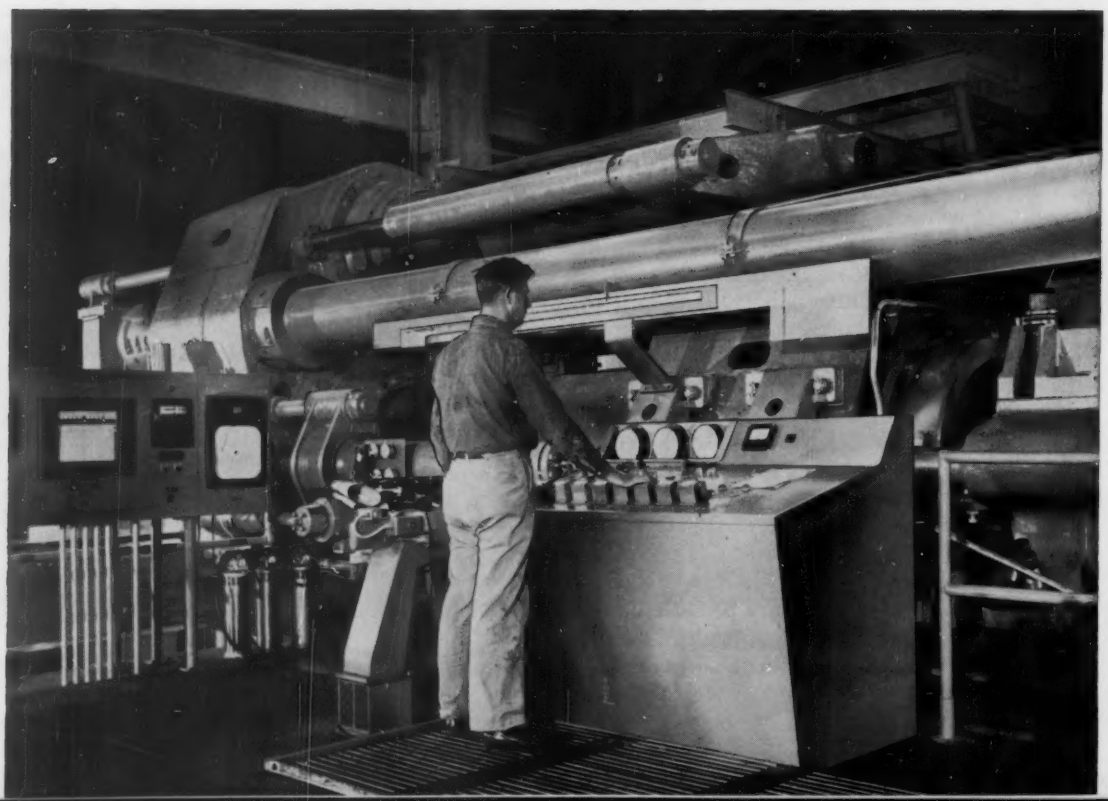
PRODUCTION under the multi-million dollar United States Air Force Heavy Press Program got under way recently when a 14,000-ton extrusion press began operation at the Lafayette, Ind., plant of the Aluminum Company of America. This press, believed to be the largest in the world for the extrusion of metal, is the first of the huge extrusion and forging presses to be leased under this program.

Giant parts produced on these presses will help aircraft manufacturers keep pace with the structural demands of supersonic planes and guided missiles, by replacing aircraft sections that formerly had to be assembled from many small components. Such extruded and forged parts will afford large savings and have an immediate effect on the design of aircraft.

The extrusion press, Fig. 1, was originally intended to produce munitions for Hitler's war machine, and was being constructed by Schloemann in Germany. At the end of World War II it was practically completed, and the United States Government placed an order with Schloemann to complete the work, and the press was purchased for shipment to this country. Under the direction of Alcoa engineers, the press was redesigned to meet American production standards and its capacity enlarged from 13,200 to 14,000 tons. A similar press of 13,200 tons capacity had already been taken behind the Iron Curtain by Russia.

The 14,000-ton unit is two and a half times as powerful as existing extrusion presses in this country, and will form four times the weight of aluminum previously possible in one "squeeze." Producing the same extrusion, the press will extrude two to four times as many pounds per hour as the largest previously existing press. Extrusions weighing as much as 2500 pounds and measuring up to 110 feet long can be produced. The size that can be produced in that length has increased from 5.4 to 22.7 pounds per foot, or from 4.5 to 19 square inches in cross-sectional area. The practical maximum circumscribing circle for shapes has increased from 13 to 23 inches in diameter.

Fig. 1. Control panel for a 14,000-ton extrusion press recently placed in operation by the Aluminum Company of America



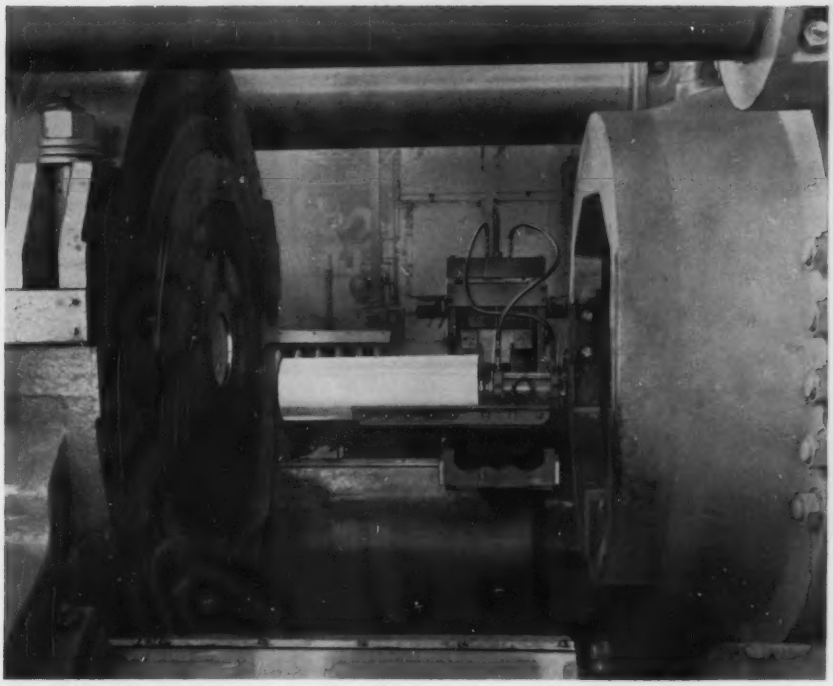


Fig. 2. Hydraulic loading device automatically places heated ingot between cylinder and platen of extrusion press.

Production on the press begins with the heating of the cast ingots in a battery of 60-cycle induction heaters, located adjacent to the press. Heater coils that can be quickly changed are provided for each ingot diameter. The ingots, which vary from 15 to 29 inches in diameter and up to approximately 70 inches in length, are heated to the required temperature at a rate sufficient to keep pace with the maximum production of the press.

Taken from the induction heating units, the ingots are fed automatically into the big press by a hydraulic loading device, Fig. 2. The loading device places the ingots in the press between the cylinder and the platen. As the cylinder is advanced toward the platen, it slides over the ingot. Cylinder length is 79 inches, and the press stroke is approximately 90 inches. Cylinders having various bore diameters are provided to handle different diameter ingots. A cylinder bore of 15 1/4 inches permits the use of a unit pressure of 153,000 pounds per square inch on a dummy block.

The press itself is of three-ram, four-column design, the forged steel columns measuring 25 1/2 inches in diameter and 57 1/2 feet long. Columns are arranged in a square pattern on 118-inch centers, permitting removal of the cylinder container by lifting up between two columns. Two rams are of 2850 tons capacity, and the center ram is of 8300 tons capacity. The press can be operated as a 5700-, 8300-, or 14,000-ton capacity unit.

Tool heating for the press is accomplished by means of low-frequency induction coils. Three water-cooled induction coils are provided to heat the die assemblies, and each coil is capable of heating a tool up to 50 inches in diameter by 28 inches thick. A large gas-fired holding furnace with three compartments is used for holding tools in readiness after induction heating. The pressure system for the press is a hydropneumatic accumulator set-up having twenty-six air bottles, four water bottles, and two water storage tanks. A system pressure of 4500 pounds per square inch is maintained by four water pumps capable of delivering a total of about 916 gallons per minute.

In the press, the ingots are squeezed into shape through dies, and delivered to a long run-out table, Fig. 3, attached to the extrusion die-holder. When the ingot has been extruded, the run-out table and die-holder are moved forward hydraulically so that the butt end of the ingot can be cut off by the shear.

Two heat-treatments—solution and precipitation treating—are normally used to improve the strength of extrusions produced on the press. Solution treating is performed after the extruded shapes leave the press, in a 120-foot long horizontal furnace. After heating in the furnace, extrusions are quenched by continuous travel on a roller conveyor through a spray chamber. Solution heat-treating is also done in vertical electric furnaces which are built directly over a deep vertical quenching tank.

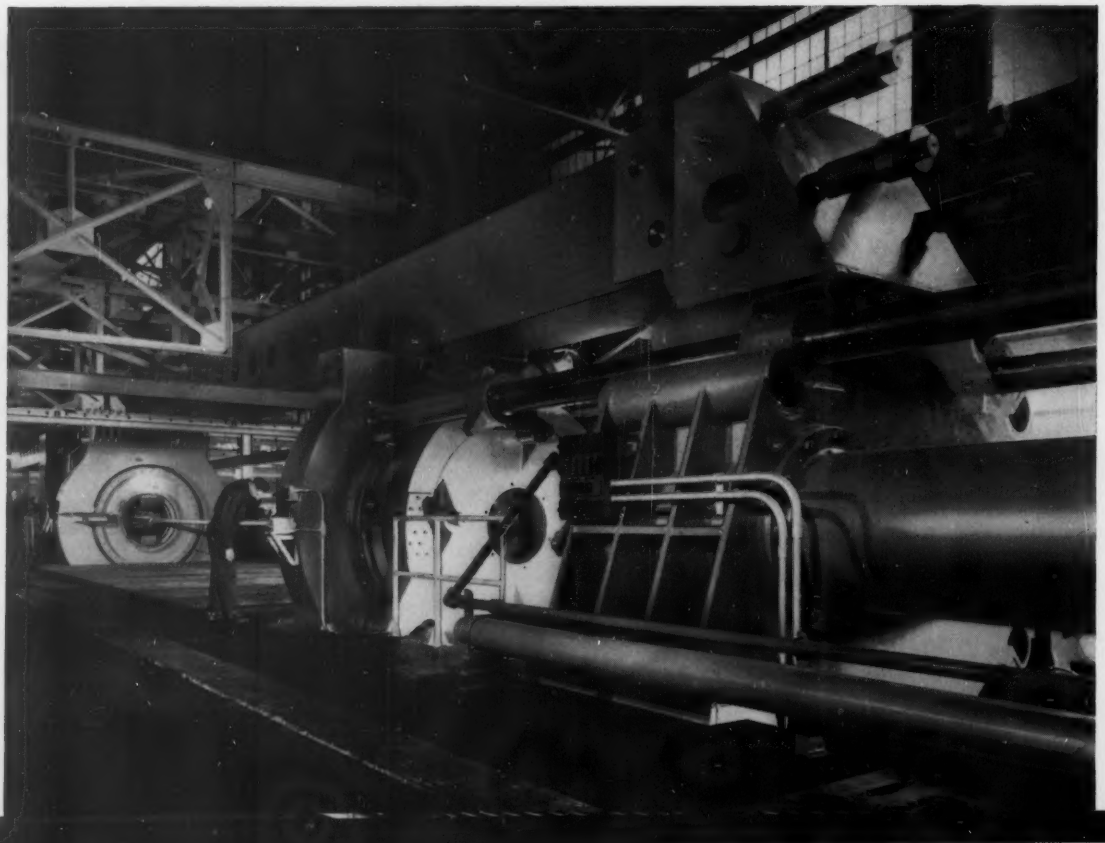


Fig. 3. Extrusion emerging from press onto run-out table. Shear is employed to cut off butt end of extruded ingot.

The next production step is performed on a 3,000,000-pound stretcher, Fig. 4, that is 180 feet long. This huge stretcher, which pulls the extruded shape to remove distortion and relieve stresses built up during production operations, was designed and installed by Alcoa as part of its $4,000,000 contribution to the new installation. The unit has four times the force of any of its predecessors, and can straighten tough, 75S aluminum-alloy shapes up to 60 square inches in cross-sectional area.

After stretching, the extrusions are cut to the required length by a 96-inch saw. A 120-foot gas-fired aging oven is used for the final precipitation heat-treatment of long lengths produced on the 14,000-ton press. Roll-contouring and untwisting machines perform supplementary operations on the extruded parts.

Fig. 4. Giant hydraulic stretcher of 3,000,000-pound capacity for relieving strains and removing distortion from extrusions



Materials OF INDUSTRY

The properties and new applications of materials used in the mechanical industries

Aluminum Association Announces New Wrought Alloy Designation System

A new system of alloy designations for wrought aluminum and aluminum alloys has been developed by the Aluminum Association, New York City, which will become effective October 1. The temper designations adopted in 1947 are being continued without change and, as in the past, will follow the alloy designations, being separated from them by a dash.

The new system, consisting of four-digit numbers, is expected to meet all of the industry's present and future needs for wrought alloys. The first digit of each designation indicates the general group to which a given alloy belongs. The last two digits identify the alloy or indicate the aluminum purity. The second digit indicates any modifications of the original alloy or impurity limits.

To aid in the transition from designations previously in use to the new system, many of the old numbers are retained as the last two digits of the new numbers. Thus, alloy 24S becomes 2024; and 61S becomes 6061.

The numbering system includes nine series of four digit numbers. The first digit of the first series is one, the second series two, the third series three, and so on.

The 1xxx series, designating minimum aluminum purities of 99.00 per cent and higher, differs basically from the other series. The last two digits indicate the minimum aluminum percentage. These digits are the same as the two digits to the right of the decimal point in the minimum aluminum percentage when it is expressed to the nearest 0.01 per cent. The second digit designates any modifications in the impurity limits. If the second digit is zero, it indicates that there is no special control on individual impurities; digits 1 through 9, assigned consecutively as needed, indicate special control of one or more impurities. Thus 1030 indicates 99.30 per cent minimum aluminum without special control of individual impurities, and 1130, 1230, 1330, for example, indicate the same purity with special control of one or more impurities.

The 2xxx through 8xxx series designate groups of alloys in which the following are major alloying elements: copper 2xxx; manganese 3xxx; silicon 4xxx; magnesium 5xxx; magnesium and silicon 6xxx- and zinc 7xxx. The 8xxx series is used for major alloying elements other than the foregoing, and the 9xxx series is unused at present. In all of these groups, the last two digits have no special significance other than to identify the different alloys in the group. Generally they are the same as those formerly used to designate the alloy. For new alloys, the last two digits will be assigned consecutively beginning with xx01.

The second digit in the 2xxx to 8xxx series indicates a modification of the alloy and replaces the letters commonly used for this purpose in the past. Thus, alloy 17S becomes 2017 and A17S, 2117; 18S becomes 2018 and B18S, 2218. Experimental alloys will continue to carry a prefix "X," which will be dropped when an alloy becomes standard.

MACHINERY'S Data Sheets Nos. 761 and 762, presented on page 255, give the aluminum alloy designation conversions.

Pre-Alloyed Steel Powder for High-Strength Applications

A pre-alloyed steel powder, called Vasco 4650-A, has been produced by the Vanadium-Alloys Steel Co., Latrobe, Pa., for use in powder metallurgy. Produced in accordance with AISI specification 4650, the powder has good green strength and is readily moldable at low pressures to yield dense, strong compacts. Basically a nickel-molybdenum composition, the grade is also available with other carbon contents. Parts made from this powder can be easily heat-treated and possess a toughness comparable to that of alloy steel.

Non-Clogging, Open-Mesh Abrasive Sheet for Sanding

The availability of Sand Screen—a non-clogging open-mesh abrasive material designed especially for sanding operations where loading or

glazing is a problem—has been announced by the Carborundum Co., Niagara Falls, N. Y. The screen-like sanding abrasive is coated uniformly on both sides with silicon-carbide grains. Its open-web construction reduces loading to a minimum by permitting sanding residue to flow freely through the numerous openings.

The material can be used wet or dry, for both machine and hand sanding operations. It comes in sheets and discs, in grit sizes of 180 and finer and can also be furnished in standard 50-yard rolls up to 18 inches wide. The material can be used flat or can be folded to any desired size for hand sanding and can also be creased and torn readily into the needed width or length. The material can be used to sand ferrous and nonferrous metals.

Nickel Alloy for Jet-Engine Turbine Blades

Waspaloy is a nickel-based, heat-resisting alloy for jet-engine turbine blades recently developed by the Pratt & Whitney Aircraft Division of United Aircraft Corporation, East Hartford 8, Conn. By using this alloy, as a turbine blade material, the power rating of the company's centrifugal-flow J-48 turbo-jet engine was raised. Its heat-resisting properties permitted the engine to operate at higher turbine temperatures for longer periods of time than before.

Pratt & Whitney Aircraft has made Waspaloy available to other jet-engine manufacturers without license fee or royalty.

Low-Cost Welded Stainless-Steel Tubing Now Available

A stainless-steel tubing is now available in commercial production quantities from the Union Steel Corporation, Union, N. J. This tubing, called Unionweld, does not require annealing after fabrication. The welding of the tubing during its fabrication is a closely controlled adaptation of the gas shielded-arc process which gives a sound, ductile, corrosion-resistant weld. The tubing is produced in a size range of from 1/4 inch to 5 inches outside diameter with wall thicknesses of from 0.010 to 0.154 inch.

Two Strong, Lightweight Resins for Dies, Jigs, and Fixtures

Two Bakelite C-8 resins, BR-18774 and BR-18795, which may be used with four hardeners specially synthesized for them to form strong, lightweight products with good chemical resistance and electrical properties have been placed on the market by the Bakelite Co., a Division of Union Carbide and Carbon Corporation, 260 Madison Ave., New York 16, N. Y. These resins cure to hard solids at low or room temperatures without applied pressure and with little shrinkage. Because of their wetting ability, they can be combined with many types of inert fillers.

Dies for drawing metal are cast from these resins when compounded and formulated for this purpose. Accurate checking fixtures, frames, patterns, tooling jigs, and dies for automotive and aircraft production all have been made from these resins.

Epoxy Resin is Base for Two Dry-Film Coatings

The availability of 'dag' Dispersion No. 213, containing colloidal graphite, and 'dag' Dispersion No. 223, containing colloidal molybdenum disulphide—has been announced by the Acheson Colloids Co., Port Huron, Mich. These two products offer the advantages of the epoxy resins as a base for dry, lubricating coatings. Films properly formed with these dispersions show good adhesion and wear resistance. They are unaffected by oils and solvents, and can be used wherever temperatures do not go above 500 degrees F. All types of surfaces, whether or not pre-treated by chemical or mechanical means, can be coated. When properly applied, corrosion resistance, as well as lubrication, can be obtained from these films.

The full value of epoxy resin films is realized by curing coatings at 350 degrees F. for thirty minutes, or at 400 degrees F. for twenty minutes. Typical uses for these products include dry lubricating films for high-temperature screw threads, precision gears, bearings, and shafts.

Sealer that Serves to Protect Against Tampering

Positive protection against unauthorized entry and handling is provided by a new Tamper Proof Sealer EC-1252 made by the Adhesives and Coatings Division, Minnesota Mining & Mfg. Co., 423 Piquette Ave., Detroit 2, Mich. The fast-drying sealer is applied over adjustable or removable parts to indicate changes in adjustment or other evidence of tampering by a break in the seal when the part is altered in position.

Access doors or removable panels on gages, and electronic and recording instruments are examples of industrial equipment that can be sealed off. In the aircraft industry, the sealer has been used effectively to protect settings and calibrations of electronic equipment, to seal guided missile parts between stages of assembly, to aid in the visual inspection of torque bolts, and also to seal canopies, compartments, and equipment, from unauthorized access.

EC-1252 is designed to adhere well to aluminum and steel. Low-temperature adhesion is good, and dried sealer can be heated slightly above 200 degrees F. for short periods with no sagging or loss of adhesion.

High-Impact Polystyrene Plastic Exhibits Toughness

A high-impact polystyrene, Styron 480, has been introduced by the Dow Chemical Co., Midland, Mich. The new formulation is tougher than general-purpose polystyrene and has improved elongation. Tests point to the use of the material in applications such as action toys, refrigerator pans, portable radio cabinets, and a large variety of other parts. They can be stapled and metal inserts molded in with ease.

The material, available in a range of opaque colors, can be readily extruded into shapes or sheet, as well as fabricated on standard injection molding machines. Sheets can be stamped, embossed, or vacuum- and pressure-formed.

Hard-Facing Alloys that Function at Red Heat

Three cobalt-chromium-tungsten hard-facing alloys in welding rod form have been brought out by Crobalt, Inc., 2800 S. State St., Ann Arbor, Mich. These materials, known as Crobalite alloys, are applied to steel and cast-iron parts to provide high hardness and good resistance to abrasion, corrosion, oxidation, and impact. They can be heated to 1600 degrees F. with no permanent loss of hardness, and are not affected by repeated heating and cooling.

These alloys are applied by oxy-acetylene or arc welding, either manually or by semi-automatic machine, using standard hard-facing procedures. They flow on readily in a uniform, slag-free layer, and bond firmly with minimum inter-alloying. When applied, the Crobalite alloys consist of a dense, hard layer of complex wear-resistant carbides evenly distributed in a cobalt matrix.

Alkaline Derusting and Descaling Compound for Precision Parts

Derusting of precision parts where dimensional change and acid embrittlement must be avoided can now be performed using an alkaline material called Oakite Rustripper. In addition to removing rust and heat scale from ferrous metals, this material has also proved effective in certain cases for descaling heat-treated titanium in aircraft plants. The manufacturer, Oakite Products, Inc., 126 Rector St., New York 6, N. Y., describes the material as a heavy-duty, off-white powder that may be used in hot or cold solutions. It may also be used with direct current to remove deep-pitted rust, or reverse current to remove heat scale. This material will not attack sound metal, will not cause hydrogen embrittlement, creates no troublesome fumes and may be disposed of in the same manner as any highly alkaline solution. Certain types of paint can be stripped at the same time that rust is removed.

Titanium Carbide Cutting Material Has High Wear Resistance

Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa., has recently developed a new carbide cutting material which contains no tungsten or cobalt. The announcement is of considerable interest because, in critical times, it will release tungsten for other purposes.

The material has a titanium-carbide instead of a tungsten-carbide base. Nickel is used as a binder instead of cobalt, and molybdenum carbide is used as an alloy carbide addition.

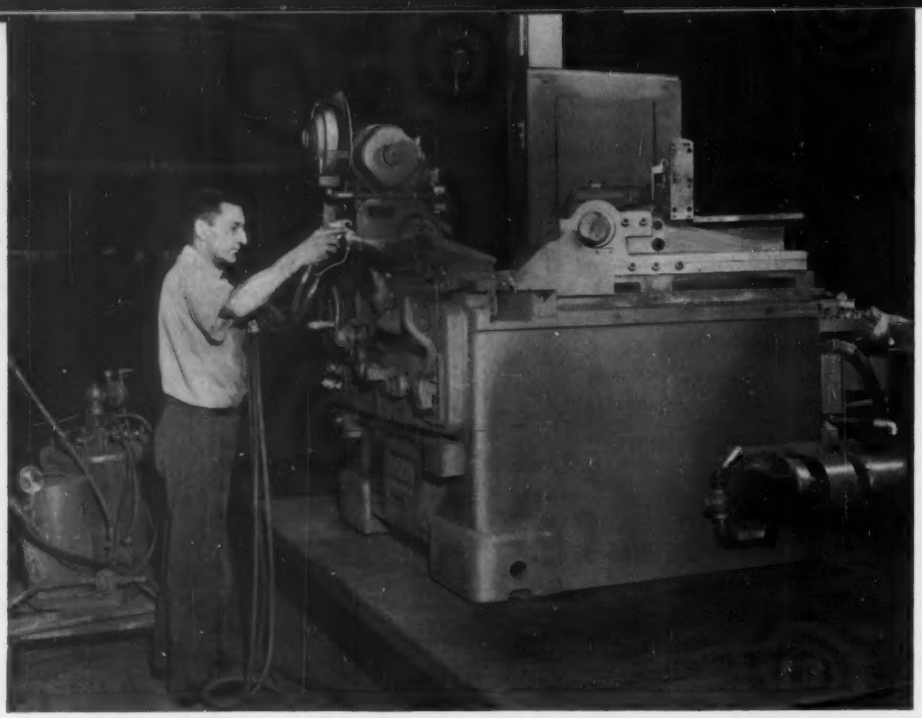
High wear resistance characterizes this material. Tool life is excellent on steady finishing cuts, particularly when high speeds and fine feeds are employed in machining hard abrasive steels. The material remains relatively cool when cutting steel without coolants.

High-Strength Titanium-Base Alloy for High-Temperature Service

A single-phase all-alpha grade titanium-base alloy that contains 5 per cent aluminum and 2 1/2 per cent tin has been introduced by Rem-Cru Titanium, Inc., Midland, Pa. Rem-Cru A-110AT, as this alloy is known, takes advantage of the good welding characteristics inherent in the alpha type grades. The aluminum provides elevated temperature strength and the tin imparts good hot workability to the alloy.

At room temperature a typical sample of this alloy has exhibited the following properties: ultimate tensile strength, 125,000 pounds per square inch; yield strength (0.2 per cent offset), 120,000 pounds per square inch; and an elongation of 18 per cent in 2 inches. At 1200 degrees F., it exhibited a tensile strength of 38,000 pounds per square inch; a yield strength of 25,000 pounds per square inch; and an elongation of about 35 per cent in 2 inches.

This alloy is recommended for all titanium parts requiring maximum strength in the temperature range of 700 to 1100 degrees F. It is used for welded assemblies, and is available in bars (for making flash-welded rings and welded structural members), plates, and sheets in thicknesses of 0.025 inch and greater. It also shows promise for use as jet-engine compressor blades.



Lacquer Hot-Sprayed on Machine Tools

SPRAYING machine tool castings with hot lacquer shows promise of becoming a routine finishing procedure, according to methods engineers at the Norton Co., Worcester, Mass. Currently, the entire production in the plant of the Grinding Machine Division is hot-sprayed as part of the painting process.

Applying the lacquer hot—at about 170 degrees F.—gives a more durable paint job, as well as some important operating economies. At the



Fig. 1. Preliminary smoothing is performed with a pneumatic grinder equipped with a Norton wheel.



Fig. 2. Shot-blasting produces a good bonding surface and gives the proper texture to the castings.

elevated temperature, the lacquer being less viscous requires less thinner. Since the solids content remains high, a more uniform coat is deposited. With the lacquer more easily atomized, less air pressure is required, and there is a consequent reduction in the amount of overspray and wasted paint.

Also, the superior flow characteristic of the heated paint gives better coverage of surface imperfections, better bonding, and a higher gloss to the finished product. Thus, much preliminary sanding and rubbing are no longer necessary. With but a single coat instead of the two or three required by room-temperature spraying, 50 to 60 per cent greater productivity is obtained from the same personnel and facilities.

A significant variation in conventional paint department equipment has been the addition of a circulating heater that is connected to the lacquer storage tanks and spray guns. The accompanying illustrations show typical activities along the hot-spray line at Norton.

Rough and irregular surface areas on castings are first smoothed with portable pneumatic grinders, such as the Ingersoll-Rand equipment shown in Fig. 1. The work takes place within a Newcomb-Detroit waterwash dust removal cabinet. At the next station on the line, Fig. 2, parts are shot-blasted in a Model 47 Pangborn unit. This operation produces a good bonding surface for the lacquer. No. 10 steel shot is used. The blasting nozzle is made of Norbide, a boron carbide claimed to be one of the hardest of man-made materials for commercial use.

In another spray booth, the insides of all housings are treated with a gear-box sealer, as in Fig. 3. Exposed surfaces are treated with a filler paste, as in Fig. 4, and when dry, sanded lightly with coarse-grit paper. Then, machined surfaces are protected with a layer of grease and two coats of "Thermo Sprafil," a filler produced by Lowe Brothers, are applied. Like the subsequent lacquering, it is hot-sprayed, as seen in Fig. 5.

The Bede circulating heater and pump used



Fig. 3. As a precaution against contamination of the lubricant, gear-boxes of housings are sprayed with a special sealer.



Fig. 4. Depressions in large castings and bases are built up with a paste filler, then sanded lightly.

are seen on the hand truck behind the castings. Spraying is performed under a pressure of 20 pounds per square inch. The filler is maintained at a temperature of 160 to 180 degrees F. After a drying period of about two hours, a coat of sealer is applied. This concludes the preliminary operations.

Hot-spraying of the lacquer is done after the machines are assembled, tested, and inspected. Finished surfaces are protected with masking tape and slushing compound. The spraying of the familiar "machine tool gray," shown in the heading illustration, is performed at 170 degrees F., with air tank and heater pump pressure of 20 pounds per square inch.

Techniques of Surface Grinding Featured in Motion Picture

The technique of surface grinding and the versatility of this type of finishing operation are presented in a motion picture film leased by the DoAll Co., Des Plaines, Ill. Operating methods and the construction, lubrication and design of surface grinding machines are fully covered, as well as proper methods of dressing and balancing grinding wheels. The 16-millimeter Technicolor, sound film has a running time of thirty-one minutes. It is available on a free loan basis to business firms, engineering societies and associations, schools, and similar organizations.



Fig. 5. Liquid filler is hot-sprayed, like the lacquer subsequently applied in the final operation.

Cotton Picker Spindles Require Some Unusual Operations

By W. P. GRONKE
Superintendent of Cotton Picker Manufacturing
Evansville Works
International Harvester Co.
Evansville, Ind.



SPINDLES with a tapered section on which sharp barbs must be produced are among the many components manufactured at the Evansville, Ind., plant of the International Harvester Co. for cotton-picking machines. Except for the head of these spindles, which is an integral bevel gear, each spindle resembles a tapered punch with four lengthwise flats. The barbs are shown being produced on these flats in the heading illustration. On a large cotton picker, there are 300 horizontal spindles—such as the one shown in Fig. 1—on each of two picking heads. Smaller machines have 210 horizontal spindles on both heads. The heads also contain 15 vertical picker bars, each having 14 or 20 spindles. Obviously, an economical means of production is essential to meet the demand for the large quantities of spindles required.

In service, every spindle is rotated rapidly about its own longitudinal axis by means of a bevel gear housed in a supporting tube. The picking head includes several vertical tubes, each with its quota of spindles, and is revolved about a vertical axis. As the cotton bolls are contacted, the fibers are snagged by the barbs and wound on the spindles. The spindles then pass under rubber doffers which remove the cotton. This is a continuous cycle.

The blanks are produced on six-spindle Acme-Gridley screw machines from 7/8-inch diameter bars of C1117 steel. In a cycle lasting twenty-seven seconds, during which the head (actually a gear blank) is formed and the shank turned, a taper is produced on the outer end by a box type



Fig. 1. Completed spindle showing tapered chromium-plated picking end with flats on which alternate rows of fourteen and seventeen barbs have been produced

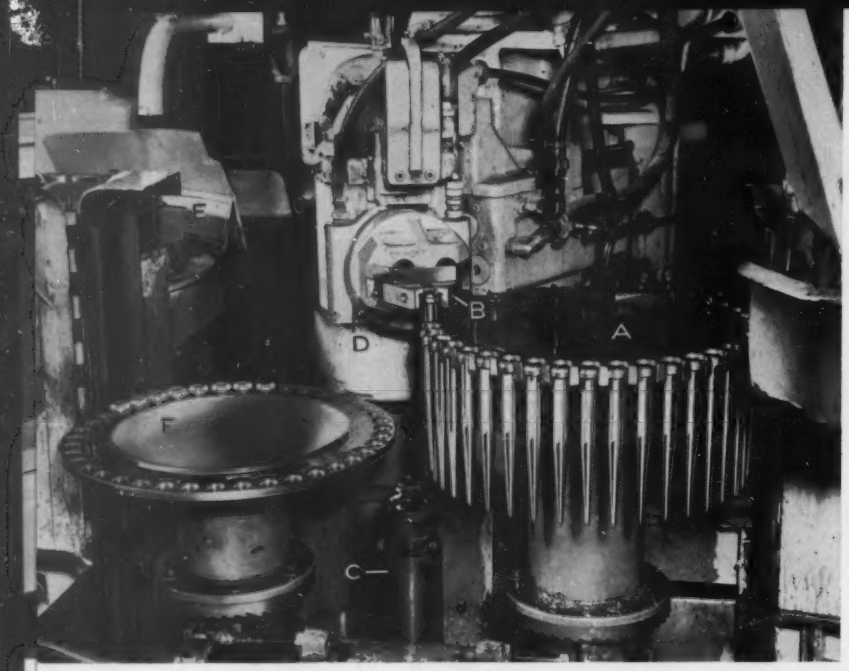


Fig. 2. (Left) Spindle blanks are fed by a loading arm from disc (A) to the work-head of the Gleason Revacycle machine where cutter (E) generates the bevel gear teeth. Loading arm (D) next transfers the completed gears to the second disc. They are then removed by hand.

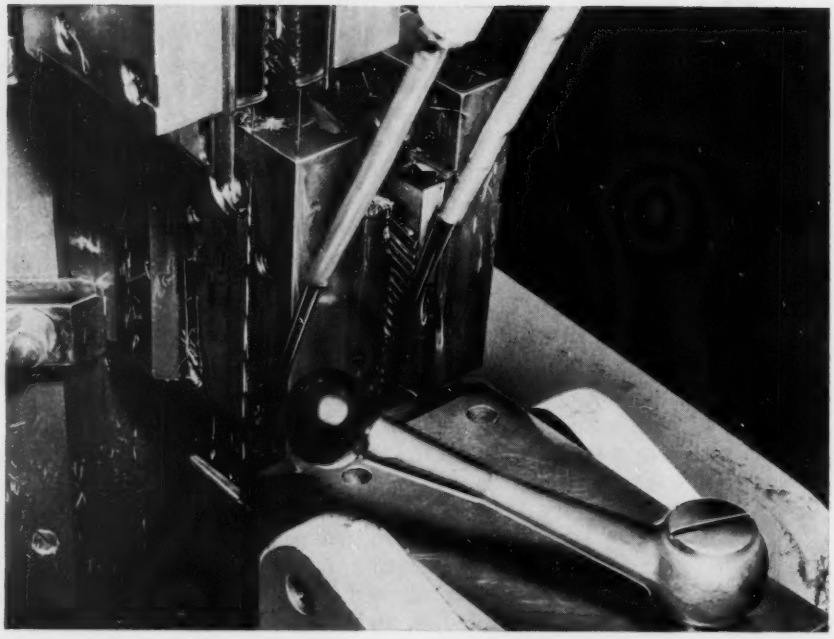


Fig. 3. (Right) Flats are broached on the tapered portions of two spindles simultaneously in this set-up. With every cutting stroke, flats are machined on two sides of each spindle in the fixture.

form tool backed up by rollers. The tool bears a resemblance to a pencil sharpener. Roughing and finishing cuts are taken before the work-piece is parted off.

Cincinnati centerless grinding machines, set up with formed wheels, are employed for rough- and finish-grinding the shank and taper in fast, hand-fed, semi-automatic operations. The blanks are then ready for gear-cutting.

To generate the straight bevel gear teeth required, Gleason Revacycle machines are used. In a completely automatic cycle, each blank is loaded, the teeth cut, and the finished part unloaded. The blanks are placed by hand in recesses in the periphery of the feeding disc shown at *A* in Fig. 2. When the blank is indexed to a position directly beneath the clamping jaws *B*, a plunger *C* raises the part so that it may be firmly gripped for loading. Loading arm *D* then pivots to the work-head of the machine, during which travel the blank is rotated 90 degrees.

The cutter, which may be seen at *E*, consists of eighteen high-speed steel segments and requires grinding only once for every 5000 gears cut. One tooth space is rough- and finish-cut during each revolution of the cutter. After completion of the cutting operation, the loading arm removes the finished gear and transfers it to the

second disc *F*, from which it is unloaded manually. Each machine cuts the gear teeth on a total of 144 spindle heads per hour. It is because of this high production rate per machine that the cost for each gear cut is kept very low.

Upon completion of this phase of manufacture, the work-pieces are transferred to a Cincinnati broaching machine, Fig. 3. Here, two spindles are held in a single fixture and are backed up by steel plates formed to the work contour. While the cutters are elevated, the fixture is advanced. On their down stroke, the broaches cut flats simultaneously on two opposing sides of the tapered portion on each of the two work-pieces. When the fixture retracts, the broaches are raised and the operator indexes each part 90 degrees for the final cut. The ground conical surface remains between the flats as the broaches do not take deep cuts. The flats vary in width from 1/8 to 7/32 inch. One man tends the broaching machine and does the loading, indexing between cutting strokes, and unloading. This is accomplished at a rate in excess of 200 work-pieces per hour.

Barbs are formed on all four flats in the special machine shown both in the heading illustration and Fig. 4. A V-shaped carbide tool is forced into the flat face at an angle of 45 degrees. This produces a depression conforming to the shape of the tool and, at the same time, raises a V-shaped barb above the flat at a corresponding angle. By controlling the depth of cut, barbs are held to a nearly uniform height.

To cut the barbs, the spindle is held in a chuck which is carried on a slide moving longitudinally along the machine bed. This slide is automatically indexed 5/32 inch by a cam that is timed to function after the cutting tool has been retracted. The tool is reciprocated by another cam which is synchronized wih the first. Starting near the end of one flat, the tool makes seventeen indentations in succession. After this, the slide is moved back, the work-piece is automatically indexed 90 degrees, and fourteen barbs are produced on the next face. These two operations are then repeated on the remaining faces. Alternate faces have seventeen and fourteen barbs, respectively, since near the point of the spindle it has proved advantageous to have barbs on only two opposing flats. Barbs are produced at a rate of approximately ninety spindles an hour.

It is desirable to have all barbs of precisely the same height but, although the tool producing them moves the same distance on each stroke, some height variation does occur. To insure final uniformity, each spindle is ground along the crests of the barbs in a Cincinnati external grinder while held in a Garrison chuck. A light cut is all that is required. This is the last machining operation performed on the spindle.

Considerable abrasive action is realized by these parts in service. To alleviate excessive wear, the parts are heat-treated subsequent to machining. A hard chromium-plating is applied as a final finish.

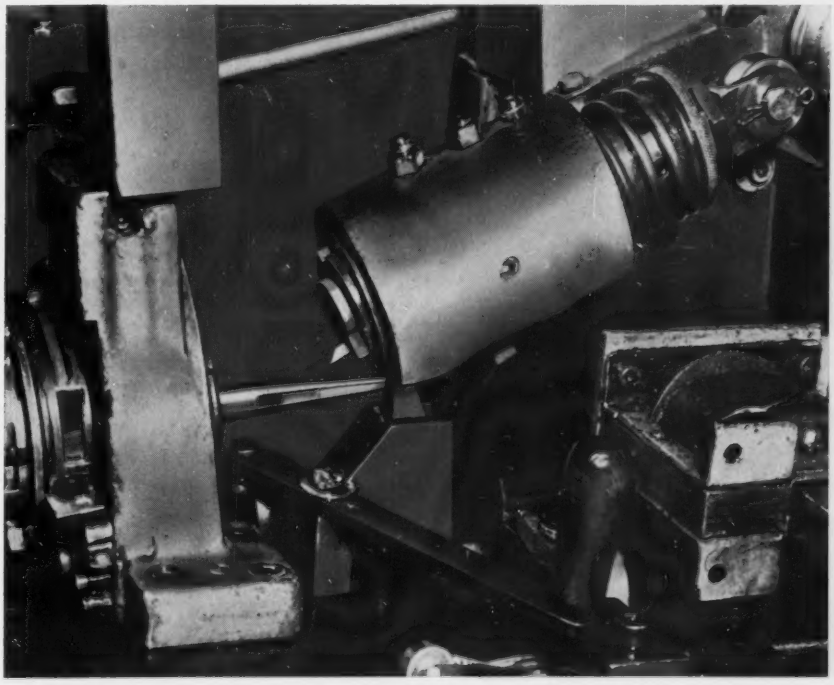


Fig. 4. Barbs are formed along the tapered flats of the spindles by a V-shaped carbide tool in this special machine. The work, held in a chuck, is indexed along a slide between reciprocations of the cam-operated cutting tool.

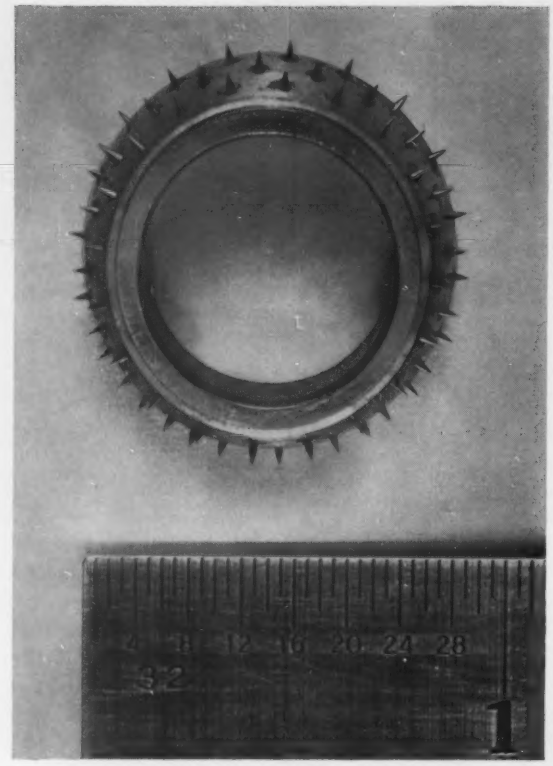


Fig. 1. Sixty tiny pins in the periphery of the temple rolls serve to keep cloth being woven under tension.

Miniature Machines Drill and Insert Small Pins

DELICATE operations that previously required the dexterity of a watchmaker are now being performed by two somewhat ingenious miniature machines. The job in question involves drilling holes and inserting tiny pins around the periphery of small brass rings, called temple rolls. These parts are used in textile manufacturing to keep tension on cloth as it is woven. The temple rolls as well as a variety of parts for turret lathes, textile machines, and earth-moving equipment, are produced at the New Philadelphia, Ohio, plant of the Warner & Swasey Co., and are components of the Sulzer weaving machines made by the concern.

A completed part is shown in Fig. 1. The pins, which are steel needle points, have a body diameter of 0.028 inch and a length of 0.093 inch. They are arranged around the temple roll in three rows of twenty pins each, with the points of the pins projecting 0.039 inch. One of the new machines automatically drills the sixty blind holes in which the pins are held; the other auto-

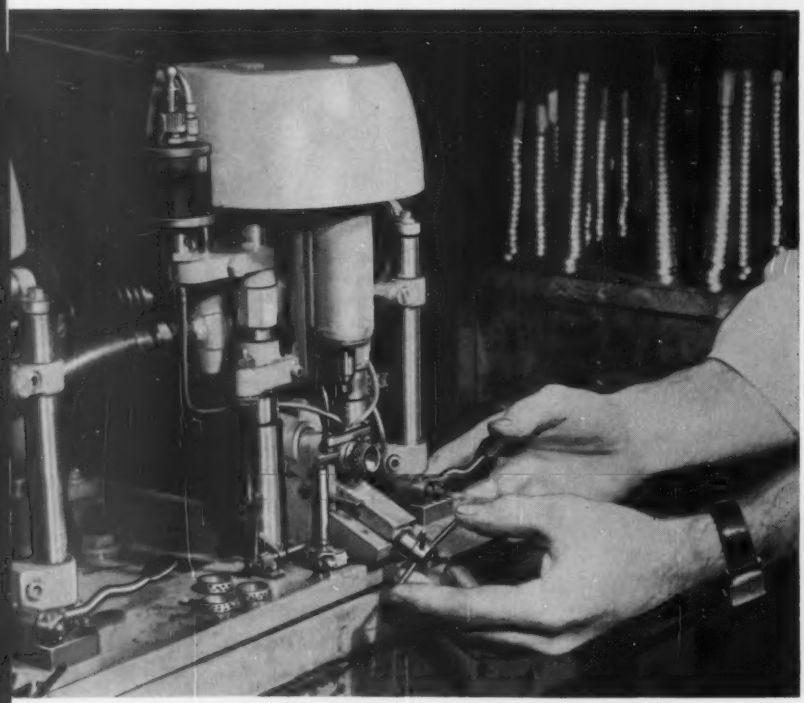


Fig. 2. Accurate and fast, the drilling unit cycles automatically to complete the holes which retain the pins.

matically inserts the pins and secures them in position by upsetting the surrounding metal slightly. Initially, the ring is formed and cut off from bar stock on a five-spindle automatic screw machine.

The drilling unit, Fig. 2, has two heads, each of which produces all sixty holes at a rate of one part per minute. The temple roll is held on an arbor and secured with a thumb-screw. To start drilling, the operator depresses a clutch lever, and a 0.7-millimeter (0.0275-inch) drill rapidly advances and retracts. The arbor indexes for all twenty holes in the row—this movement is also automatic, being timed to the stroking of the drill quill. On the return stroke, a jet of air rids the flutes of chips.

Drilling the three rows in sequence is accomplished by changing the front-to-rear setting of the work-arbor beneath the jig bridge-piece. To provide for this, the arbor is mounted on a three-position slide, actuated from a pin wheel. When a row is drilled, the clutch disengages, the pin wheel is operated, and the cycling then repeated. In resetting the work-arbor, it rotates slightly, giving the pins a staggered pattern, as can be seen by referring to Fig. 1.

The other machine, Fig. 3, performs the pinning operation. Production rate of this unit is a completed temple roll assembly every three minutes. As in drilling, cycling is automatic. Pins to be inserted are lifted from a hopper to the chute seen above the mechanism. This loading is done by a small motor behind the chute which, through a worm and worm-wheel, rotates a scoop in the hopper. A vibrator attached to the chute assists the descent of the pins and prevents jamming.

In the chute is a slot that serves to reject pins traveling pointed-end first. These are collected in a jar and later dumped back in the hopper. Only pins traveling blunt-end first can be accepted by the mechanism.

Next, the pins reverse their direction of travel by dropping on another vibrator-assisted chute which slants toward the back of the machine. Upon reaching a cam-operated pusher, they are forced one by one onto a pick-up arm and carried into alignment with a hole in the temple roll. At this moment, a ram supporting a punch moves in, picks up the pin, and starts to push it into the temple roll. Meanwhile, a jaw swings in and releases the hold of the arm on the pin. The ram continues to push the pin into the temple roll to a predetermined depth. The punch, being hollow, encloses the point of the pin and upsets the surrounding brass metal, thus holding the pin firmly in place.

Upon the retraction of the ram, the work-arbor automatically indexes by means of a ratchet cam, bringing the next hole in the temple roll into pinning position. When a row has been completed, a clutch disengages and the operator relocates the work-arbor for a new row.

The two miniature machines were designed and built by Paul Klamn, tool-room foreman of Warner & Swasey's Cleveland, Ohio, plant.

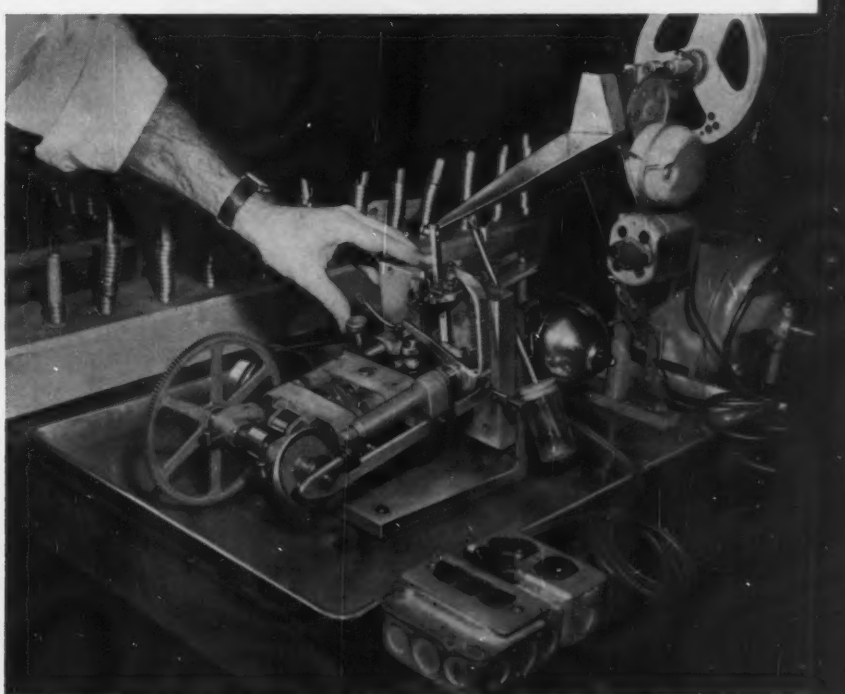


Fig. 3. This unit inserts and secures the pins in the drilled holes of the temple roll.

Multiple-Spindle Automatics Now 100 Per Cent Carbide-Tooled

By GEORGE SUNDELL, Engineer
Kennametal Inc.
Latrobe, Pa.

MULTIPLE-SPINDLE automatics completely equipped with tungsten-carbide tooling enable production of turned parts to be doubled, and in some cases tripled. In the application here described, production was increased 2.8 times. This increase enabled the manufacturer to produce enough parts on one machine to satisfy his expanded assembly line, saving the cost of an additional machine—an estimated $40,000.

The operation consists of machining transmission drive gear forgings at the New Process Gear Corporation, Syracuse, N. Y. These parts are made of AISI 4028 steel, 2.540 inches in diameter. Previously, they were produced in two separate operations. Turning, facing, drilling, reaming, grooving, and chamfering cuts were taken on a four-spindle Cone automatic and a turret lathe, using a total of twenty-three conventional cutters—seventeen on the automatic and six on the turret lathe. With both machines operating at 240 R.P.M. and at an 0.008-inch feed, twenty-five parts per hour were produced.

Now, an eight-spindle Cone collet chucking machine, utilizing twenty tungsten-carbide cutters (Kennametal Grade 6), operates at 714 R.P.M. and turns out seventy parts per hour. A close-up view of the tooling is shown in Fig. 1. The grade of carbide selected is particularly suited to the relatively fine feeds used. Feeds per revolution are as follows: cross-slide, 0.0023 inch; center-slide, 0.006 inch; and reamer auxiliary, 0.010 inch. Depths of cut taken are 0.0625 inch for roughing (except drilling), and 0.015 to 0.020 inch for finishing.

The drawings, Fig. 2, represent the machining sequence. At present, tool life is running from 800 parts per grind on the outside diameter grooving tool (position No. 5) to 8000 parts per grind on the inside diameter relief grooving tool (position No. 7). The average number of pieces per grind for the entire set-up is between 1500 and 1600.

One manufacturer was able to tool a six-spindle bar stock machine to produce a taper-bored ring by using only two spindles for the complete operation. Duplicate tooling was set up on the other two pairs of spindles, and three completed parts were turned out in each cycle. The tapered bore was cut by a single-point cutter supported in a lever-operated holder, the slide of which was designed at the required angle.

Reductions in both floor-to-floor time and "down" time are primary cost-saving advantages in a carbide set-up. Careful consideration must be given to the proper choice of spindle speed so that the carbides will operate at their most effi-

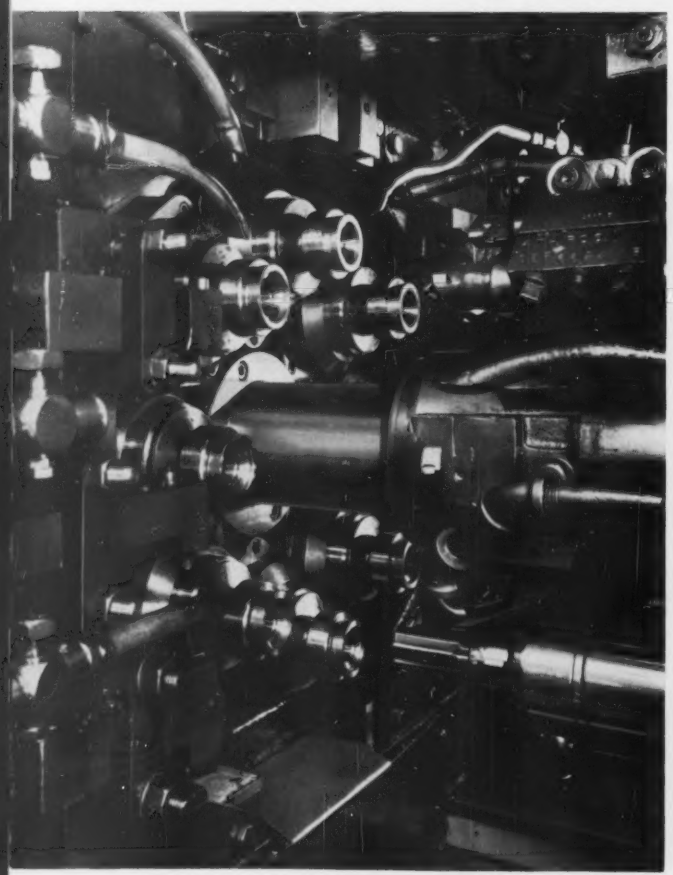


Fig. 1. All eight spindles of this automatic machine are completely tooled with tungsten carbide

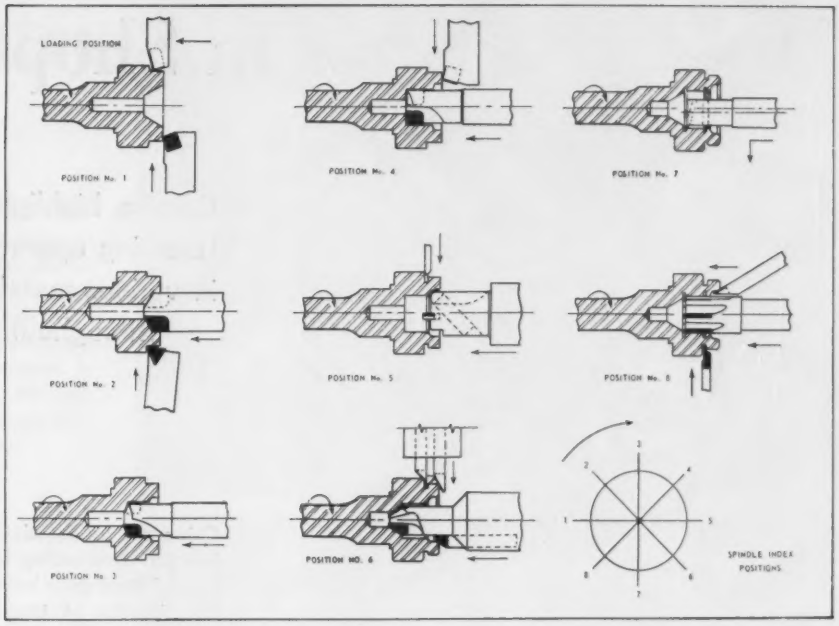


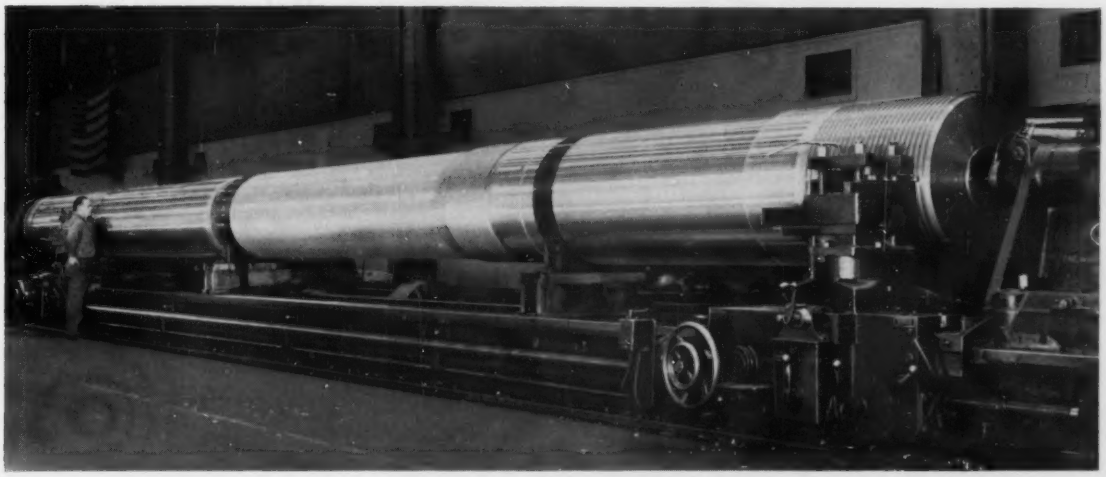
Fig. 2. Mechanically held carbide-tipped cutters play an important part at several of the machining positions as here illustrated.

cient level. Feed rates should be chosen to give proper cutting action. Operators should be furnished with a duplicate set of cutters, to speed change-overs and reduce the amount of adjustment necessary. Mechanically held tools are ideal in this respect, and are particularly adaptable to both turning and facing operations.

Tool-holders should be designed to take advantage of the high degree of rigidity built into automatic multiple-spindle machines, in order to give maximum support to the cutting edge and insure good tool life. This fact was demonstrated with a 3/16-inch cut-off blade, which did not give adequate tool life until a high-speed steel shank was used.

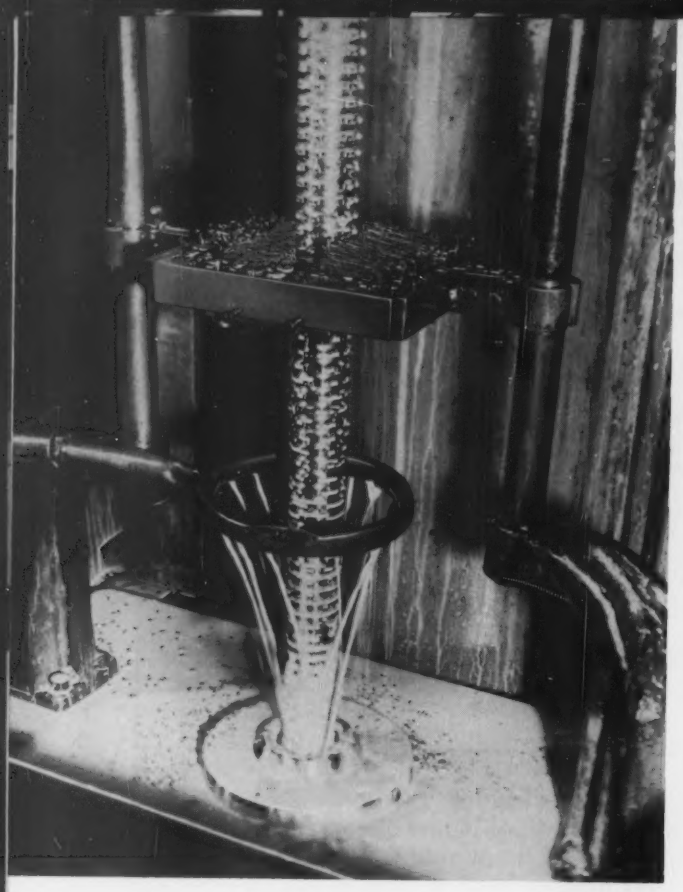
Coolants and chip-breakers assume great importance with carbides because of the accelerated machining rates of automatics. The compact design of these machines produces, in most instances, intense heat in a multiple-cutter set-up, and the use of a coolant is recommended. Flow of the coolant, to be effective, must be ample.

Machining a 181,000-pound forged steel column in the New Castle, Pa., plant of the United Engineering & Foundry Co. This is one of eight such columns which will be used in a 35,000-ton forging press that the company is building for the United States Air Force. The column measures 60 feet 10 inches long, and is 36 inches in diameter. It has an 8 1/2-inch diameter hole bored lengthwise through its center. The shaft is being turned on a 72-inch engine lathe which has a 75-foot bed.

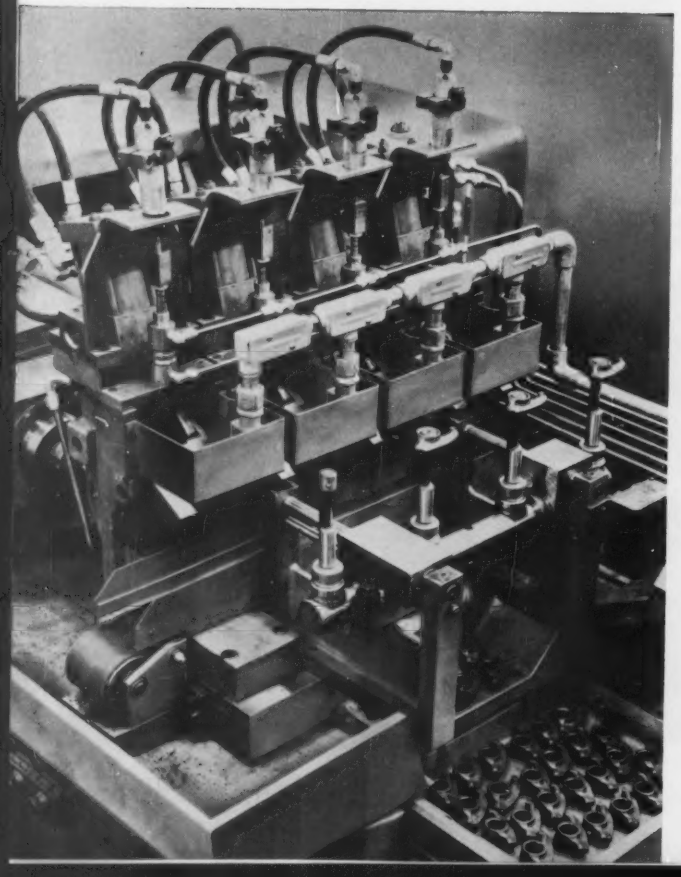


In Shops Around

Camera highlights of some interesting operations performed in various metal-working plants throughout the nation

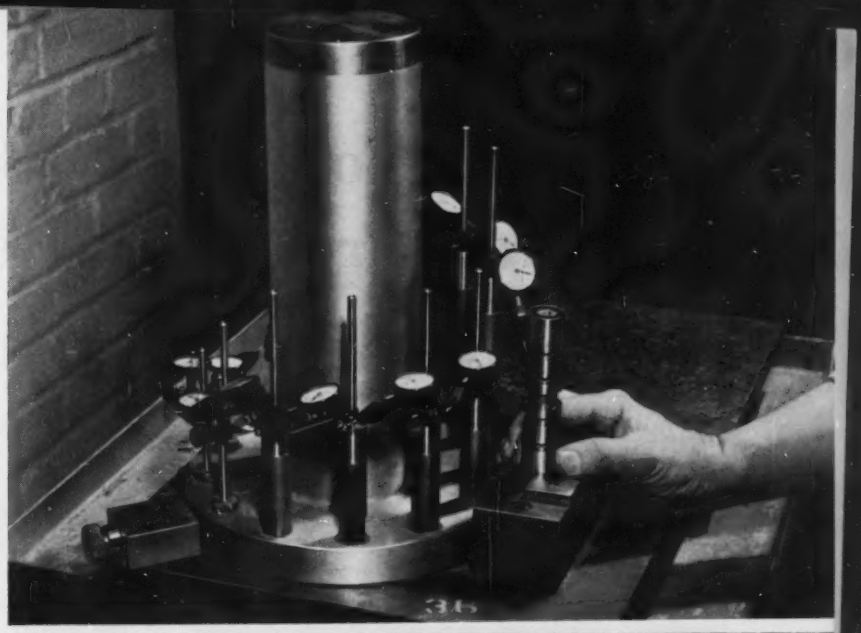


Chips are automatically brushed from a broach after cutting internal splines in a forged steel gear blank at the Louisville, Ky., Works of the International Harvester Co. The brushes, manufactured by the Osborn Mfg. Co., are mounted just above the coolant ring in such a manner as to surround the broach with wire bristles.



Boring rocker arms on a Heald Bore-Matic with the aid of a quadruple loading mechanism. Four upright stakes are hand-loaded with rocker arms and swung into a clamping fixture. An air hammer firmly seats the parts in the fixture, after which they are automatically clamped, bored, unclamped, and ejected onto a conveyor.

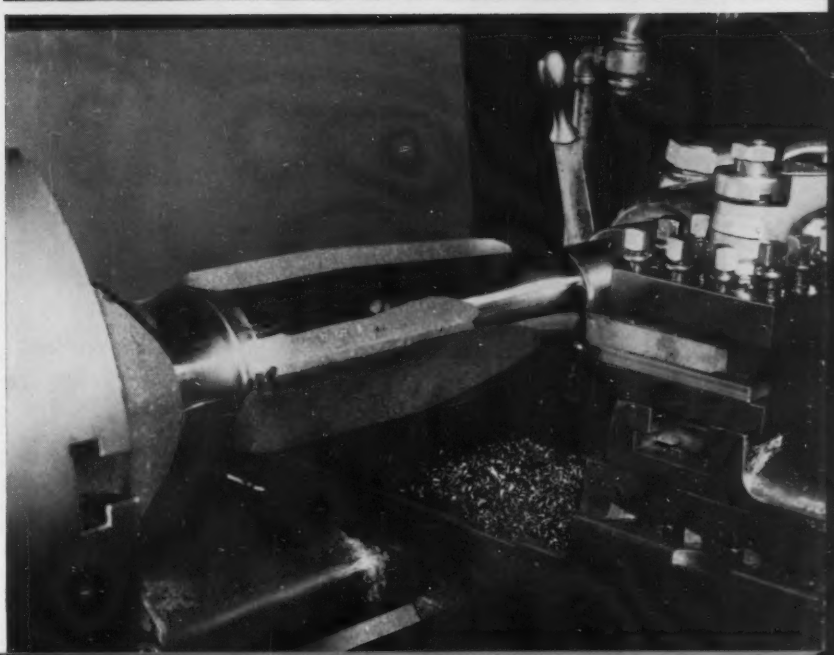
the Country



Checking location of grooves in a hydraulic valve component at the Norton Co., Worcester, Mass. A precision turntable, having eleven Federal dial indicators mounted at heights corresponding with the groove locations, is used. As the table is rotated, the indicators bear on each surface in succession.



Steel sheets are easily raised for a punch press operator at the Cutler-Hammer New York plant by means of a Basco magnetic separator. The separator induces a magnetic field among the stacked sheets with the result that they tend to repel each other. Thus the ends fan out, air space being left between each sheet.



Profiling steel rotor-yoke forgings at the Morton, Pa., plant of the Piasecki Helicopter Corporation. A triangular tungsten-carbide insert, manufactured by Kennametal, Inc., is used on the tool bit for this interrupted cutting operation. Since two forgings can be profiled by each cutting edge, indexing the insert permits the machining of six yokes before insert replacement.

Low-Cost Press Tools for Moderate Production Requirements

By G. C. Matson
Tool Design Engineer
Western Electric Co., Inc.
Chicago, Ill.

At the Hawthorne (Chicago, Ill.) plant of the Western Electric Co., Inc., it has been found necessary to provide a large number of punches and dies for producing parts having relatively small requirements. Many of these parts are, however, required in quantities too large to be made economically with dies of low melting point alloy such as Kirksite. Yet because there can be no assurance of future orders for these parts, the cost of providing tools of conventional construction is excessively high.

Costs of dies for jobs in this intermediate-quantity category have been sharply reduced by means of a method of manufacturing the die details, developed through the cooperation of the product engineers, metallurgists, tool designers, and tool construction organization at Hawthorne. The perforating punch and die seen in Fig. 1 illustrates an application of this method. This tool pierces 123 holes, varying from 0.127 to 0.384 inch in diameter, in aluminum-alloy plates 9 3/8 inches long by 6 inches wide and 1/16 inch thick. The total requirement for this particular part was 35,000 plates. It is estimated that over 100 hours (approximately 30 per cent of the construction time) was saved by the methods used in producing this tool.

In this type tool, details such as the punch retaining plate *A*, stripper *B*, and die *C*, Fig. 2, are made of precision ground, flat steel stock whenever possible. This oil-hardening steel stock is available commercially in a variety of thicknesses and widths which suit most design conditions. The only machining required in making die blanks from this material is cutting the stock (of suitable width and thickness) to the required length.

When a relatively small production is anticipated, the die blanks are first heat-treated to obtain a hardness of 37 to 39 Rockwell C, after which the die openings are jig drilled and taper reamed to the finished dimensions shown on the



Fig. 1. Low-cost die for piercing 123 holes in each of 35,000 aluminum-alloy plates 9 3/8 by 6 inches and 1/16 inch thick

tool drawings with no further heat-treating required. Screw- and dowel-holes for mounting the plates on die sets in the conventional manner can be machined either before or after heat-treating.

Dies of this hardness are being used for making parts from aluminum and brass, 1/32 inch thick or less, providing that the number of parts required does not exceed 100,000. When both the stock thickness and number of parts required are near the upper limits for these semi-hard dies, the hardness may be increased to between 39 and 41 Rockwell C. Dies of this hardness may be machined by using the same technique as followed for soft dies. However, it is generally necessary to employ somewhat lower feeds and speeds than those used in machining soft dies.

In cases where longer die life is needed—such as when more than 100,000 parts are required, or thicker stock is to be worked, or the parts to be made are of steel—the die openings are finish-machined first. Then the die is heat-treated to attain a hardness of 58 to 61 Rockwell C. For all low-cost punch press dies, the customary grinding after heat-treating is eliminated. No difficulties have been encountered in maintaining product tolerances for the parts on which this type of tool is used.

To reduce the possibility of damage to the low-cost, semi-hard dies, certain design precautions are observed so as to minimize deflection. Punch retaining plates are made somewhat thicker than usual to provide adequate support for the punches. Punches are selected with large-diameter heads and bodies, and having a perforating stem as short as possible. The large heads eliminate the need for a back-up plate, while the large shank and short stem minimize deflection. Since

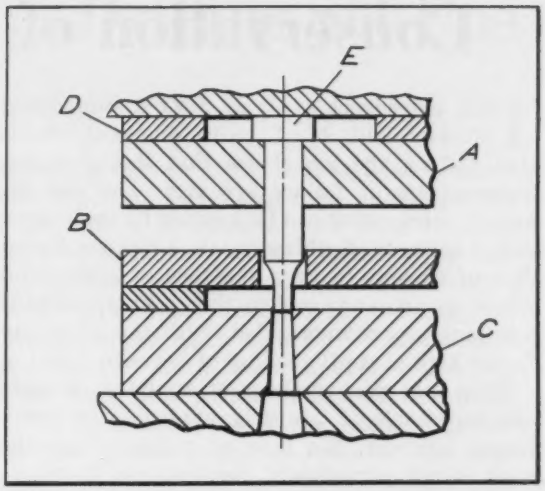
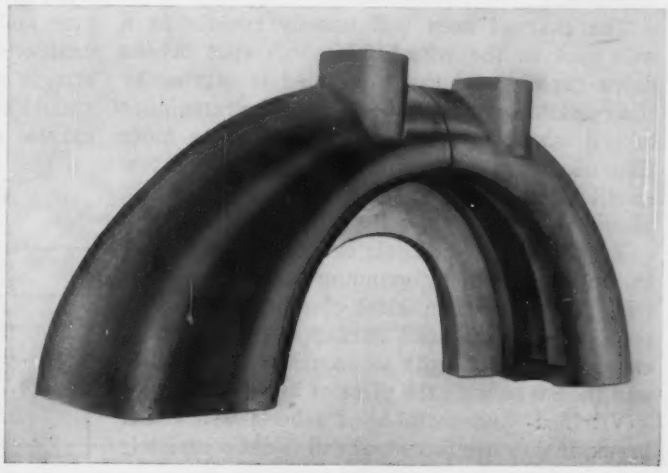


Fig. 2. Typical details of low-cost die. Precision ground, flat steel stock is employed for punch-plate (A), stripper (B), and die (C).

punches of this type will be given only a few sharpenings before being discarded, long punch life is not a consideration.

Die costs have been further reduced by employing, wherever possible, commercially available standard perforating punches, such as the one shown at *E* in Fig. 2. Such punches are interchangeable and can be re-used to produce different parts requiring various arrangements of the punches. Holes in the punch plate are made to a standard reamer size. The use of the spacer *D* eliminates the need for counterboring 123 holes in the punch-plate. Die plates *C* are generally made from 1/4 to 3/8 inch thick. However, thicker stock is employed for dies having cross-sectional areas that are weak or poorly supported.

The use of cement-bonded sand in the foundry of the Chambersburg Engineering Co., Chambersburg, Pa., made possible the production of a large core for a cast-iron exhaust casing without the use of the customary core-box or arbors. The mold for the outside of the 48,000-pound casting was made first. This mold was lined with sand to the thickness of the casting walls. The core was then made within this layer of sand.



Conservation of Diamond Wheels

THE experience of J. K. Smit & Sons, Inc., Murray Hill, N. J., with diamond wheels that fail on the job shows that the most frequent causes of failure are avoidable. For example, overheating can be avoided by the proper use of coolants. Nothing equals a copious forced flow of coolant to keep the face of a diamond wheel clean and cool-cutting. Water soluble solutions are recommended, with the alkalinity factor kept at a pH reading of between 7 and 8.

Wick and mist methods of applying coolants are acceptable if properly applied. Too many times, however, the flow of coolant from the wick is not periodically checked, and there accumulates on the wick a moist muck, consisting of diamond, wheel bond, and tungsten-carbide particles, which is not cleaned away. This results in the forming of a lapping compound.

Another example of avoidable wheel failures is that caused by wheels not being dressed on the machine to running truth. This type of failure does not make itself apparent when a good flow of coolant is used. On dry grinding, and with improper use of the wick method of cooling, it becomes noticeable very quickly.

When the wheel is run dry and not in running truth, the full load of work is absorbed by only part of the diamond section. This causes abnormal expansion of the wheel at the contact area. The bond will char at this point and, if the wheel is continued in use, charring of the bond will eventually spread to other parts of the wheel —even though these parts are not in contact with the work. Sometimes this condition is determined only after the wheel has been in use for a few minutes, but by then it is too late to prevent initial damage to the wheel. If continued in use for even short periods, the usual result is rapid wheel wear.

The charred area will usually remain as a soft spot in the wheel. This soft spot breaks down rapidly and the work load is carried by the remaining part of the wheel. The remainder of the wheel, in turn, breaks down at a more than normal rate, causing short wheel life. A few minutes taken to true the wheel when it is first placed on the spindle will prevent waste.

Resinoid-bonded wheels can easily be dressed to running truth by grinding the surface of a piece of low-carbon steel clamped in a fixed position. The diamond surface should be indicated to running truth as accurately as possible and then true with the piece of low-carbon steel.

Vitrified- and metal-bond wheels will either break, if they are forced, or fail to cut completely unless they are running true. Both of these bonds must be dressed by grinding to truth on the work-spindle, using a grinding wheel of about 60 grit, silicon carbide grain, medium hardness. This operation should be performed with a coolant. It is always good practice when using any diamond wheel to indicate the wheel to running truth within 0.0005 inch with a dial indicator gage.

The improper selection of grit size is another cause of wheel failure seldom recognized. It is essential that the proper grit size be selected, and there must be limitations on the amount of feed per pass or the speed of traverse. If it were assumed that the particle of any given grit size were spherical in shape, then the diameter for a particular grit size would be as shown in the accompanying table.

The feed per pass can easily be controlled when it is below 0.001 inch by attaching a dial indicator gage, reading in 0.0001-inch increments, to the slide of the grinder. With this arrangement, accurate measurements of feed per pass can be obtained. Depth of cut per pass is not the only controlling factor. Speed of traverse is also important.

If the surface of a diamond wheel is examined, it will be noticed that the diamond particle is practically completely embedded in the bond with very little of the diamond particle exposed. That is why the recommended down feeds are low, as shown in the table. If, for example, a 100 grit wheel is used, the down feed per pass should be limited to 0.001 inch and table traverse to 10 feet per minute. The amount of contact area and the flow of coolant will affect the above figures.

Also to be considered is the selection of the correct wheel for the type of work to be done. This involves using a recommended wheel diameter and face width in which the proper concentration of diamond particles, in the correct size, is embedded. The depth of diamond section should be sufficient to provide the most economical use for the proposed application.

Grit Sizes and Recommended Cut Depths for Diamond Wheels

Grit Size	Diameter, Inch (Approximate)	Recommended Depth of Cut per Pass, Inch
80	0.007	0.001
100	0.006	0.001
120	0.005	0.001
150	0.004	0.0005
180	0.003	0.0005
220	0.002	0.0005
320	0.001	0.00025

Special Card Expedites Drilling Set-Ups

By Herbert Chase

MANY adjustable multiple-spindle drilling set-ups are used in the Endicott, N. Y., plant of the International Business Machines Corporation to aid in more rapid drilling of a wide variety of parts. As there are hundreds of different parts and the number produced at any one time is often small, frequent changes in set-up are required. Consequently, set-up time is a considerable factor in total drilling cost.

Many of the parts produced are too small to permit the use of all, or even most, of the spindles in a single down feed of the head. Hence, a different set of holes is often drilled or reamed by shifting the jig holding the part into different locating positions between successive down feeds. This procedure also makes it possible to drill and ream the same hole in successive down feeds, and to do work on holes spaced too closely to permit them to be drilled with a single down feed of one head.

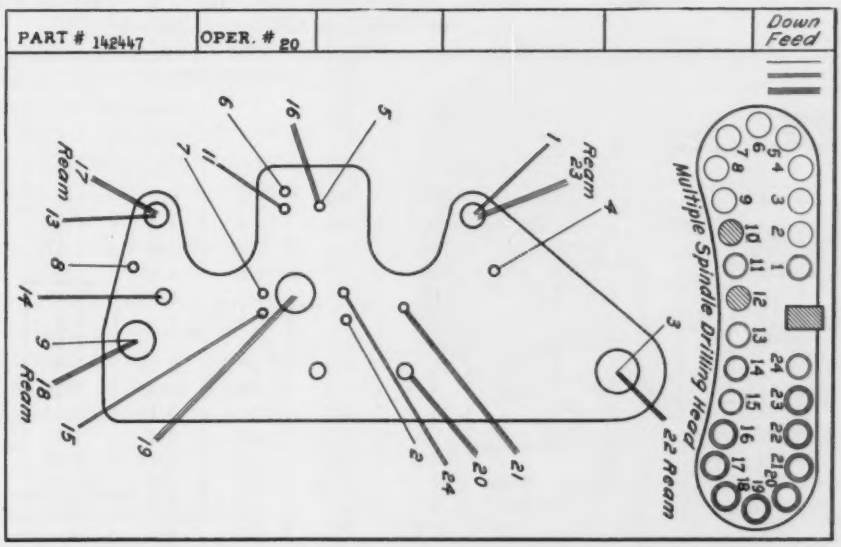
Once a set-up is made, a required lot of parts can be run through quickly. However, it is rather slow and difficult to make a set-up if one must be guided only by a print of the part. Consequently, to expedite set-up work, as well as to avoid confusion and reduce the chance of errors that may result in considerable scrap, a special form of 5- by 8-inch set-up card shown in the drawing has been developed.

Each card contains a scale outline drawing of the part, showing the location and approximate size of each hole. At the right-hand end of the card is a plan view of the drilling head in which each spindle is designated by a number. Holes in the outline drawing of the piece are also numbered to indicate which spindle will operate on each hole. Some holes have two numbers—one for drilling and the other for reaming.

At the upper right-hand corner of the card the number of down feeds required to complete all the holes in a part is indicated. If, for example, three down feeds are needed for the part shown, each is given a color (in the illustration, single, double, and triple lines are used instead of colors). The spindles are marked in the corresponding colors. Thus, for the set-up illustrated, Heads 2 to 9, inclusive, are used during the first down feed; Heads 1, 11, 13, 14, 15, and 24 during the second down feed; and Heads 16 to 23, inclusive, during the third down feed. For this part, Heads 10 and 12 are not needed.

By reference to this diagram, kept in a transparent plastic cover, the operator knows what heads are to be tooled for each successive down feed. The part drawing shows the size of tool and hole spacing to be set; and the fixtures, aid in these settings.

On the reverse side of the card are the feed rates, speeds, material, type of coolant, safety precautions, and special directions and remarks, as well as a listing of standard tools and gages required in the set-up. Although lengthy written instructions could convey similar information, this graphical aid is convenient and quick to use.



Reproduction of the front face of a typical card employed to facilitate setting up multiple-spindle drill presses. Numbers on outline drawing of part indicate which spindle in the head is to be tooled for the corresponding hole.

Standardization of Minimum Bend Radii for Sheet Metal

By BERNHARD ROGGE
Evaluation Engineer
U. S. Army Chemical Corps

CUSTOMARY practice in the metal-working industry, particularly in aircraft manufacturing plants, is to maintain bending radii for sheet-metal parts to an absolute minimum. These radii are usually determined from a series of bend tests in which metal blanks are bent at right angles to successively smaller radii until fracturing in the bend occurs. Such methods have resulted in a series of minimum bend radii, sometimes varying from each other by only 1/64-inch increments, for various thicknesses and different materials. When radii must be held to such close dimensions, they are difficult to duplicate due to spring-back of the material. Also, if a variety of parts must be produced from materials of different thicknesses, numerous dies and other tools would be required.

It is generally thought that radii must be kept as small as possible in order to save weight. However, careful study and analysis revealed that the weight factor is negligible—being only a very small fraction of the total weight in most cases. Also, in some instances, an increase in bend radii produces a reduction in weight, since a larger radius takes less metal than a sharper bend, providing that the over-all flange width is not increased.

For these reasons, it is believed that specified bend radii could be liberalized, with one radius applying to several thicknesses and different

Table 2. Recommended Minimum Bend Radii for Various Thicknesses of Different Magnesium Alloys

Thickness, Inch	At Room Temperature (70 Degrees F.)		At Elevated Temperature (400 Degrees F.)	
	DOW Ma AM C52S–O DOW FS–la	DOW Mh AM C52S–H DOW FS–1h	DOW Ma AM C52S–O DOW FS–la	DOW Mh AM C52S–H DOW FS–lh
0.016	1/8	3/16	1/8	1/8
0.020	1/8	1/4	1/8	1/8
0.025	1/8	1/4	1/8	1/8
0.032	3/16	5/16	1/8	1/8
0.040	3/16	5/16	1/8	1/8
0.050	1/4	3/8	1/8	3/16
0.063	1/4	1/2	1/8	3/16
0.071	5/16	5/8	3/16	1/4
0.080	3/8	11/16	3/16	1/4
0.090	3/8	13/16	3/16	5/16
0.100	7/16	7/8	1/4	5/16
0.125	9/16	1 1/8	1/4	7/16

Table 1. Recommended Minimum Bend Radii for Various Thicknesses of Different Aluminum Alloys

Thickness, Inch	Aluminum Alloy										
	75 S and Alcad 75S		Alclad 14 S and Clad R 301			Alclad 24 S			61 S		52 S–O, 2S (up to ½ H), and 3S (up to ¼ H)
	Condition		Condition			Condition			Condition		
	–O	–T6	–O	–W	–T	–O	–T4	–T3	–O	–T	
0.016	1/8	1/8	1/8	1/8	1/8	1/8	1/8	1/8	1/8	1/8	1/8
0.020	1/8	1/8	1/8	1/8	1/8	1/8	1/8	1/8	1/8	1/8	1/8
0.025	1/8	1/8	1/8	1/8	1/8	1/8	1/8	1/8	1/8	1/8	1/8
0.032	1/8	3/16	1/8	1/8	1/8	1/8	1/8	1/8	1/8	1/8	1/8
0.040	1/8	3/16	1/8	1/8	1/8	1/8	1/8	3/16	1/8	1/8	1/8
0.051	1/8	3/16	1/8	1/8	3/16	1/8	1/8	1/4	1/8	1/8	1/8
0.064	1/8	1/4	1/8	1/8	3/16	1/8	3/16	5/16	1/8	1/8	1/8
0.072	1/8	5/16	1/8	3/16	1/4	3/16	3/16	3/8	1/8	3/16	1/8
0.081	1/8	3/8	1/8	3/16	3/8	3/16	1/4	7/16	1/8	3/16	1/8
0.091	3/16	7/16	1/8	3/16	3/8	3/16	5/16	7/16	1/8	1/4	1/8
0.102	3/16	1/2	1/8	1/4	7/16	1/4	3/8	1/2	1/8	1/4	1/8
0.125	3/16	5/8	3/16	3/8	1/2	1/4	7/16	9/16	3/16	5/16	3/16
0.156	3/16	3/4	3/16	7/16	9/16	3/8	1/2	11/16	1/4	3/8	3/16
0.188	1/4	1	1/4	1/2	5/8	1/2	5/8	13/16	1/4	7/16	1/4
0.250	3/8	1 1/4	1/4	5/8	3/4	5/8	3/4	1	1/4	1/2	1/4

Table 3. Recommended Minimum Bend Radii for Various Thicknesses of Different Steels

Gage No.	Thickness, Inch	Corrosion-Resisting Steel					SAE 4130 Steel		Low Carbon Steel
		Annealed	¼ H	½ H	¾ H	H	Annealed	Normalized	
29	0.0135	1/32	1/16	1/16	1/16	1/16	1/32	1/32	1/16
26	0.0179	1/32	1/16	1/16	1/16	1/16	1/16	1/32	1/16
24	0.0239	1/32	1/16	1/16	1/8	1/8	1/16	1/32	1/16
22	0.0299	1/32	1/16	1/8	1/8	1/8	1/16	1/16	1/16
20	0.0359	1/16	1/16	1/8	1/8	3/16	1/16	1/16	1/16
19	0.0418	1/16	1/16	1/8	1/8	3/16	1/16	1/16	1/16
18	0.0478	1/16	1/8	3/16	1/8	3/16	1/16	1/8	1/16
16	0.0598	1/8	1/8	1/4	3/16		1/8	1/8	1/16
14	0.0747	1/8	1/8	5/16	5/16		1/8	3/16	1/8
13	0.0897	1/8	3/16	3/8			1/8	3/16	1/8
12	0.1046	1/8	3/16	7/16			1/8	3/16	1/8
11	0.1196		1/4	1/2			1/8	1/4	1/8
			1/4						

materials. Recommended minimum bend radii for various thicknesses of different materials are listed in the accompanying three tables.

In the simplified recommendations for aluminum alloys, Table 1, most of the thinner sheets have been consolidated under a 1/8-inch bend radius. Since 85 per cent of all the aluminum sheets used in aircraft manufacturing—regardless of alloy, condition, or thickness—are within this 1/8-inch radius classification, it is obvious that bending operations and tooling requirements could be greatly simplified and production costs lowered. For example, numerous form dies and punches having the same contour but different radii could be eliminated.

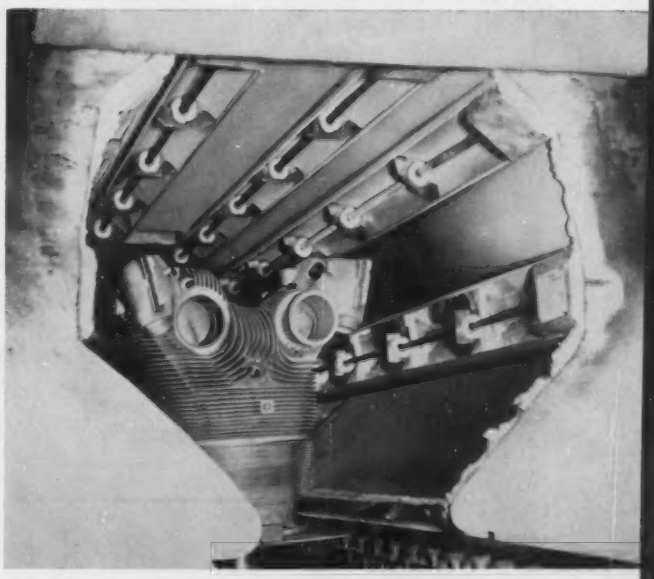
Also, set-up time on the forming machines would be reduced, and less maintenance would be needed with fewer tools. Inspection and assembly fixtures could be standardized, and they could be produced more economically with simplified bend radii. Engineering and design time would also be saved by eliminating the need for looking up references, and insuring uniformity and interchangeability of the parts.

Radiant Heat Speeds Assembly of Shrunk-Fit Parts

For the installation of shrunk-fit parts in aircraft engines, Capital Airlines at Washington National Airport has turned to far-infrared radiant heat for preheating engine cylinders on a conveyorized basis. Important advantages gained in changing from the former gas-torch heating method include a 30 per cent increase in assembly production, a saving of 25 man-hours weekly, and cleaner, cooler working conditions.

The flexible radiant tunnel has infinitely variable control and is readily adapted to handle several different types of cylinders for engines which are overhauled. Tunnel construction consists of six Chromalox electric radiant heaters rated at 3.6 kilowatts each, which are enclosed in an insulated shell and mounted on structural framing over the conveyor line.

The heaters concentrate radiant heat on the valve opening areas of each cylinder while reflected aluminum spacers, inserted between the heaters, increase radiant effectiveness and help retain convection heat. Correct temperatures for each type of cylinder are obtained by varying the setting of a percentage type input controller. Additional control is provided by a regulator which limits temperatures to 650 degrees F.



Close-up view of far-infrared tunnel, showing locations of electric radiant heaters that concentrate heat on aircraft-engine cylinders

Five Hundred Dollars in Prizes for Articles on Ingenious Mechanisms

MACHINERY is offering $500 in cash prizes for the eight best original articles on ingenious mechanisms to be submitted before January 1, 1955. Each article should be confined to a description of one mechanism or one mechanical movement that has proved its practicability in actual use, and has not previously been described in the technical press.

Here is how the awards shape up:

First prize	$200
Second prize	$100
Two additional prizes	$50 each
Four additional prizes	$25 each

But this is not all. MACHINERY'S high-level space rates will be paid not only for the prize articles but also for all other articles that are accepted for publication that may not receive a prize. In other words, although your material may not win one of the eight prizes, you still stand to receive payment for your efforts. Another point—you need not be a subscriber to the magazine.

Forward as many articles as you like. They will all be entered in the competition and may all be accepted for publication—but no contestant will receive more than one cash prize.

The Procedure is Simple

1. Send a drawing of the mechanism (or photograph if preferred—or both) that clearly shows all important parts of the particular movement to be described.

2. Describe as clearly as possible both the *purpose* of the mechanism and its *action—how* it does *what* it does.

3. Mark the important parts on the drawing, such as levers, cams, etc., with letters, *A*, *B*, etc., and use corresponding letters to identify those parts in the description; thus, "Lever *A* is operated by cam *B*." This will help to make the description readily understood.

4. Confine each article to a single mechanism or movement; do not describe an entire machine or refer to parts that do not affect the movement being described.

A Few Helpful Hints for Contestants

Clear blueprints or pencil drawings with distinct lines are satisfactory for illustration. They should be made on separate sheets of paper. Send only drawings that are to scale, with the various parts shown in correct relationship and proportion. Rough free-hand sketches cannot be used. The drawing should show the assembled mechanism, although a diagram may be substituted if it more clearly illustrates the arrangement of a complicated mechanism.

Avoid describing a mechanism that is familiar to most designers; descriptions of movements that are generally known cannot be accepted, even though they may be very ingenious. It is immaterial how long ago a mechanism or movement was designed, provided it has not previously been published.

And Finally, the Mailing Address

Mechanisms Contest Editor
MACHINERY
148 Lafayette St.
New York 13, N. Y.

INGENIOUS *Mechanisms*

Mechanisms Selected by Experienced Machine Designers as Typical Examples Applicable in the Construction of Automatic Machines and Other Devices

Reciprocating Cam with Half-Cycle Dwell

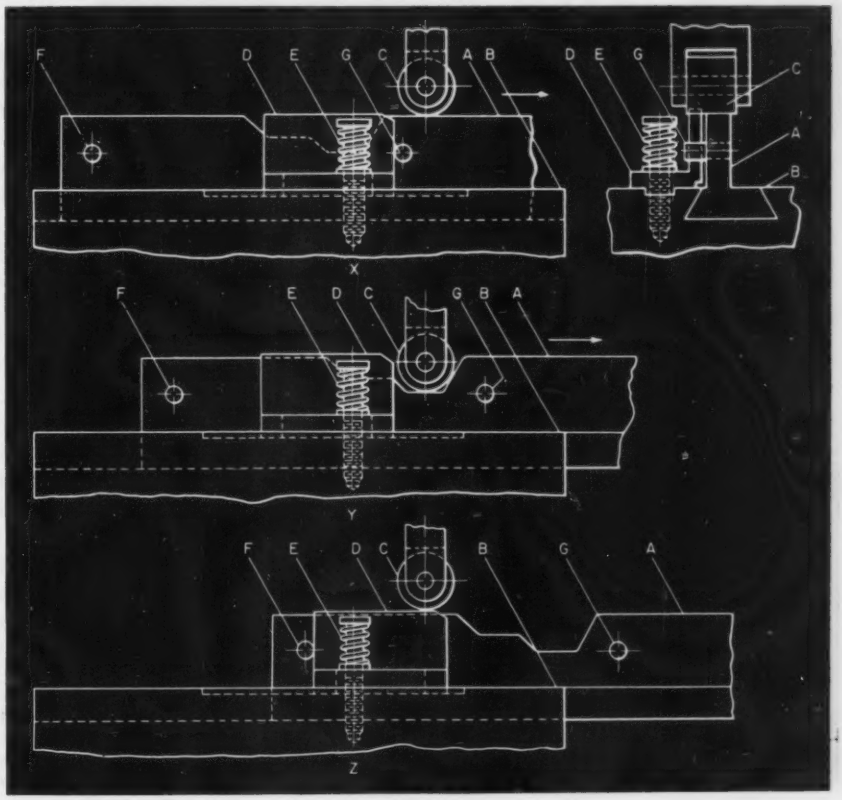
By L. KASPER, Philadelphia, Pa.

An irregular reciprocating motion was required on a machine used in the production of a formed wire part. This indicated the necessity of a cam. Due to the absence of a rotating part to which a conventional cam could be attached, it was decided to use a nearby reciprocating member to carry a straight cam. This, however, presented one drawback in that a reciprocating cam transmits motion to the follower on both the forward and the return strokes, the movement being reversed on the latter. As this was not permissible, the modified cam shown in the accompanying illustration was designed.

Cam-slide *A* rides in a dovetailed groove machined in a stationary part *B* of the machine. Follower *C* contacts the cam surface of the slide, as shown at X. Adjacent to the cam-slide is a short groove in which rides a small slide *D*. Friction is maintained on the slide, which is slightly higher than the cam surface, by spring *E*. The spring is retained by a stud that passes through a slot in the base of the slide. Two pins *F* and *G* protrude from the side of the cam.

The components can be seen at X in the position they assume at the beginning of a stroke. As the cam-slide moves in the direction of the arrow, follower *C* traces a path along the cam outline, as shown at Y. Continued movement of the cam permits pin *F* to contact slide *D* and force it under the follower, as illustrated in view Z. Due to the height of the small slide, the follower is lifted out of contact with the cam. This completes the first phase of the cycle of operation during which the desired reciprocating motion was transmitted to the follower linkage.

On the return stroke of cam *A*, pin *F* breaks contact with the small slide, which is held stationary by spring friction. The follower, being supported on slide *D*, also remains stationary. At the end of the return stroke, pin *G* strikes the opposite side of the small slide, forcing it to the left, as shown again at X. In this manner,



Follower receives motion from reciprocating cam during forward stroke, but dwells during return stroke.

movement of the follower takes place during the initial half of the cycle only. During the second half of the cycle a dwell period is substituted for the follower movement.

Safety Devices Protect Slides Against Overloads

By W. M. HALLIDAY, Southport, England

In the design of a machine, it may be important to protect a slide and its elements against excessive overloads. Where the slide is driven from an oscillating shaft, either of the two safety devices illustrated in Figs. 1 and 2 proves highly satisfactory. For clarity, the slides themselves have been omitted from each illustration.

In Fig. 1, the movement of the slide, connected to the right end of link *A*, is transmitted from an oscillating drive-shaft *B* through a lever *C*. This lever swings in an arc an equal distance each side of its vertical position. The lever and link are joined by a pin *D* which passes through close-fitting holes in the end of the lever and in a bushing *E* located in a slot *F* in the link. A collar *G* is doweled to the protruding end of the pin, keeping the bushing in position.

The pin also passes through a hole in the left-hand end of a second link *H*. This link is shorter and somewhat narrower than link *A*. Also, its right half is further reduced in width, and has the form of a fine-pitch tooth rack along the lower edge. The teeth have a 45-degree side angle and engage mating teeth cut along the upper edge of a rectangular block *J*. This block is made thicker than link *H* so that it can be registered in a shallow depression in the face of link *A* to which it is secured by a set-screw *K*.

Welded to the top edge of link *A* is a hollow stud *L*. A detent *M* in the bottom of the stud has two flat surfaces fitting a tapered slot cut across the top edge of link *H*. The top of the stud is tapped to receive an adjusting screw *N*. A blind hole in this screw contains a spring *O* which forces the detent to remain in the slot, thus keeping the tooth rack and block in engagement. Within the stud, a key *P* prevents the detent from rotating.

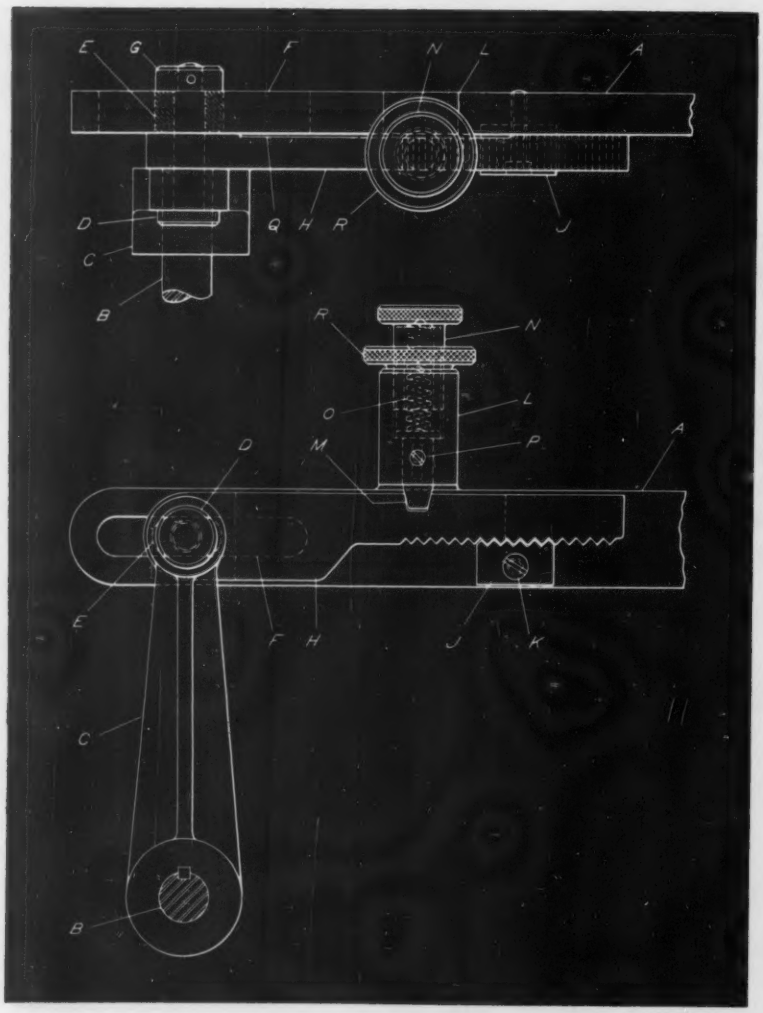


Fig. 1. The original path of transmission through this safety device is resumed automatically when the overload has been removed.

In the normal operation of the slide, there is no independent travel of the bushing *E* in the slot *F*. Instead, the path of transmission from lever *C* to the slide is through link *H* and block *J* to link *A*. Should the slide become overloaded, further movement of lever *C* and link *H* in either direction will raise the detent out of the channel, and the tooth rack will disengage block *J*.

Lever *C* and link *H* are then free to continue their movements, with the bushing *E* now traveling back and forth in the slot *F*. (The length of the slot is made slightly more than the stroke of the slide.) Since no movement is transmitted to link

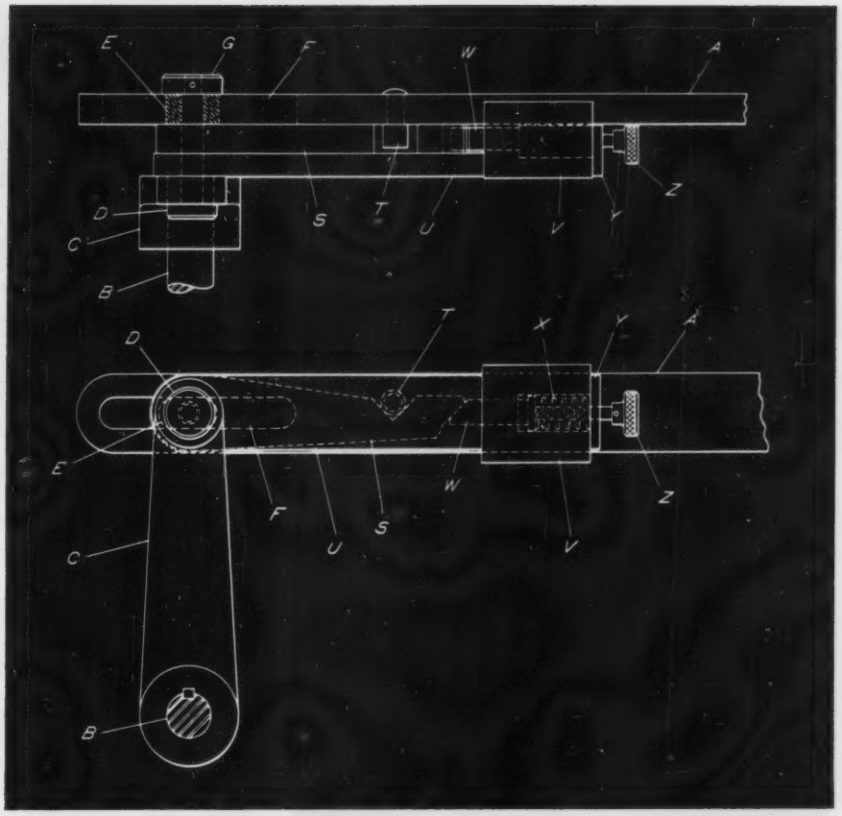


Fig. 2. This safety device can be used where a stud projecting above the links would be impractical.

A, the slide is protected. To reduce the friction of link *H* on the face of link *A*, the former is relieved in area *Q*.

Once the overload is removed, the original path of transmission is resumed automatically. Adjusting screw *N* is pre-set to have spring *O* impart just enough pressure to permit the detent to be raised at a specified amount of overload. A jam nut *R* maintains the setting of adjusting screw *N*.

The safety device shown in Fig. 2 can be used where, because of space limitations, a stud cannot be located over link *A*. Here, link *A*, drive-shaft *B*, lever *C*, pin *D*, bushing *E*, slot *F*, and collar *G* are the same as their counterparts in Fig. 1, and similarly identified.

Link *S*, Fig. 2 (corresponding to link *H*, Fig. 1) at its left end fits over pin *D*. The upper edge of this link tapers to the right, and also forms a 90-degree vee around a hardened pin *T* pressed into the face of link *A*. A third link *U*, also fitting over pin *D*, is considerably longer than link *S*, and has an integral block *V* at its right-hand end. The back of this block straddles the upper and lower edges of link *A*.

A plunger *W*, contained in a hole in the block, has a 45-degree point, matching a 45-degree slope on the end of link *S*. A spring *X*, which is retained by a cover plate *Y*, causes the plunger to exert a pressure contact against link *S* so that the sides of the vee normally bear on pin *T*.

In operation, the path of transmission from lever *C* to the slide is through link *S* and pin *T* to link *A*. Should the slide become overloaded, the movement of link *A* is arrested, and link *S* in dropping down from pin *T* causes a momentary retraction of plunger *W*.

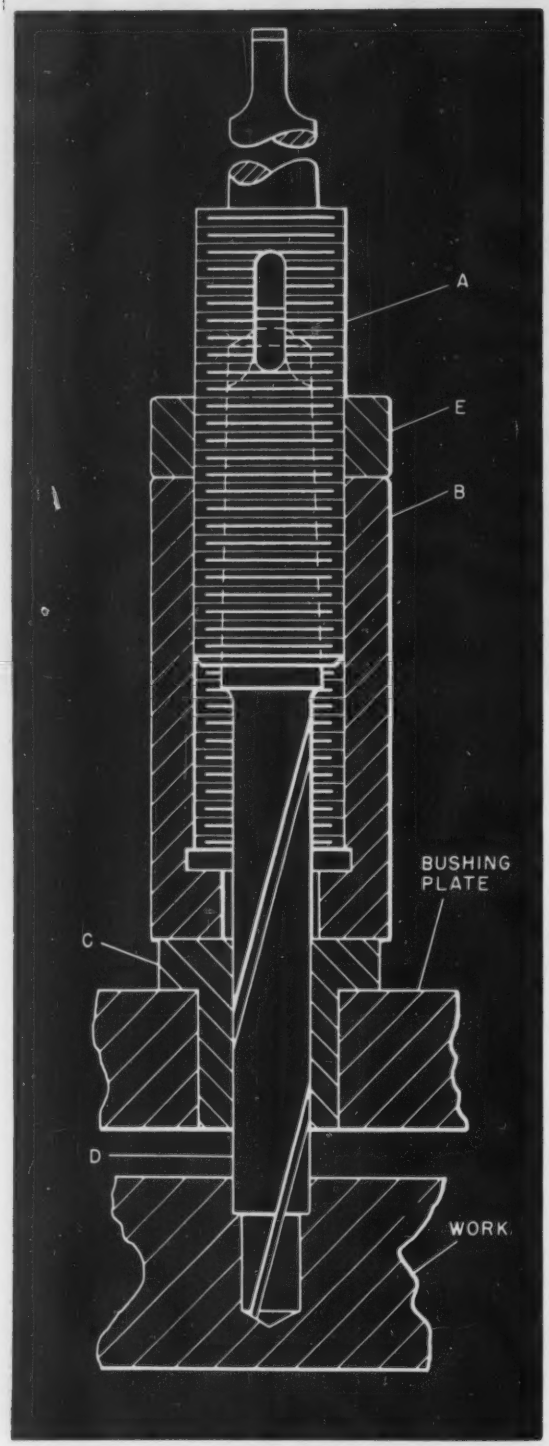
As is the case with the first safety device described, lever *C* and link *S* are then free to continue their movements, with the bushing *E* now traveling back and forth in the slot *F*. No movement is transmitted to link *A*. But unlike the first device, the original path of transmission here is not resumed automatically once the overload is removed. Instead, the knurled knob *Z* on the end of the plunger shaft must be pulled out while lever *S* is raised to position. The rear of the knob is milled flat in order to clear link *A* and keep the plunger point in alignment with the slope on the end of link *S*.

* * *

Silicones Increase Efficiency of Springs

The Hydra Spring Division of the Wales-Strippit Corporation of North Tonawanda, N. Y., has announced that through the use of special silicones provided by General Electric research, the efficiency of its springs has been greatly increased. The liquids formerly used in Wales Comproils provided a compressibility of 6.2 per cent at 20,000 pounds per square inch, the maximum operating pressure of the Hydra spring. However, with the silicone liquids, the compressibility has been raised to as high as 12 per cent at 20,000 pounds per square inch, producing a substantial increase in efficiency. Twice the force or stroke for the same size spring is achieved.

Ideas for Shop and Drafting-Room



Depth stop for use on a drill press, which is threaded on the outside of extension socket (A) in order to provide accurate depth control

Accurate Depth Stop Integral with Drill Socket

By ROGER ISETTS, Kenosha, Wis.

Depth stops usually found on drill presses are seldom sensitive enough for applications where a high degree of accuracy is required. By making the stop an integral part of the drill, better depth control can be obtained.

An inexpensive method of combining a drill with a positive stop is illustrated. This set-up is versatile in so far as it can be used with all drills having shanks in the same taper range.

Fine-series threads are cut along the outside diameter of standard extension drill socket *A*. A length of hexagonal steel bar stock *B*, which has been bored, tapped, and hardened, is threaded on the extension socket. This female member is then adjusted in height so that its lower face will strike the head of bushing *C* when the drill *D* reaches its desired depth. A lock-nut *E* prevents the hexagonal bar from turning during use.

Storage Rack Keeps Nuts Properly Assorted

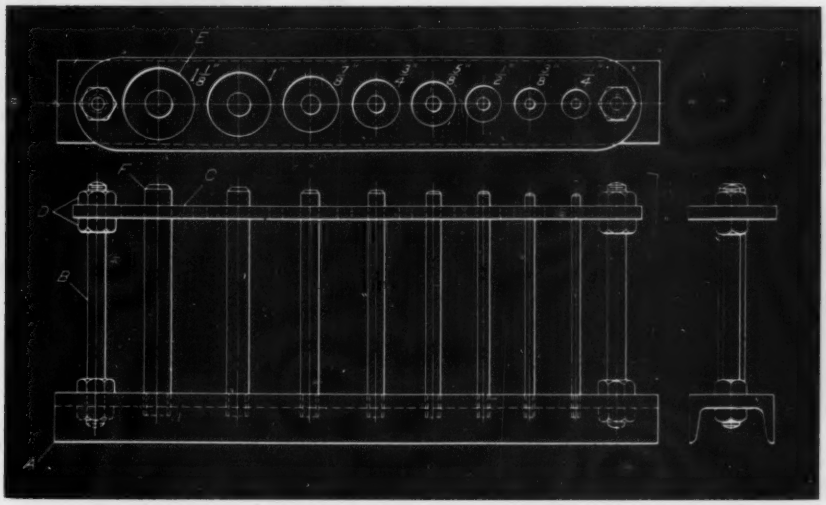
By W. M. HALLIDAY, Southport, England

An adequate supply of hexagon nuts, orderly arranged and convenient to the machinist, contributes to shop efficiency. In the illustration is shown a simple storage rack for this purpose. The rack is foolproof in that different sizes of nuts cannot possibly become mixed.

A piece of channel iron *A* provides a good base. Near each end of the base is a drilled hole which accommodates a tie-rod *B*. These tie-rods are of any suitable length, determined by the number of nuts that are to be stored. At their top, the tie-rods run through a rectangular bridge-piece *C*. To bind the base and bridge-piece together, both ends of the tie-rods are threaded and engage two adjusting nuts *D* each.

Holes *E* are drilled centrally along the length of the bridge-piece between the tie-rods. In the illustration, eight such holes are shown, but any desired number may be provided by simply extending the length of the base and bridge-piece. The diameters of the eight holes are different, each one being made approximately 1/64 inch more than the cross-corner width of a particular size of nut.

Cylindrical rods *E* are mounted in the base,



The differences in the diameters of holes (*E*) and rods (*F*) make it impossible to stack incorrectly.

being tightly screwed into tapped holes in that member, and concentric with their corresponding holes in the bridge-piece. The diameter of each rod is made approximately 1/64 inch less than the minor diameter of the thread for the respective size of nut. It will be observed that each rod projects above the bridge-piece approximately 1/4 inch, and is chamfered at its top to facilitate filling the rack with nuts.

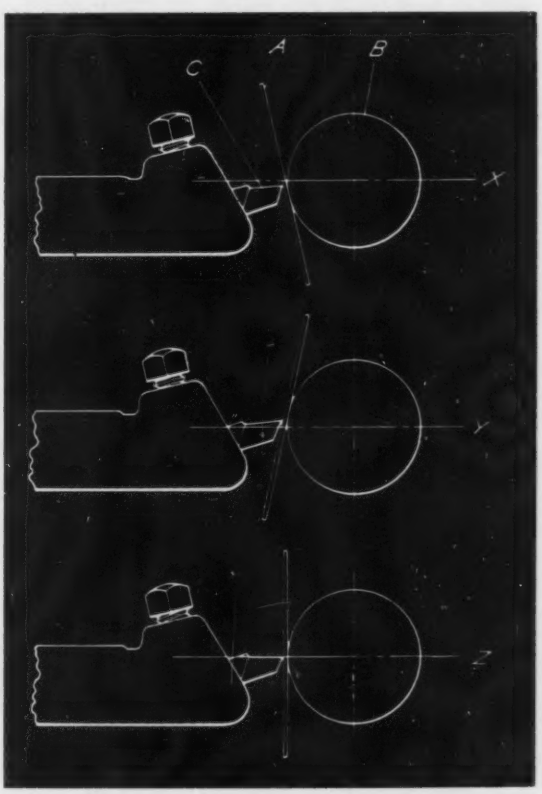
To load nuts on such a rack it is only necessary to slip them over the rods. Because of the differences in the diameters of the bars and the holes in the bridge-piece, it is impossible to stack a standard hexagon nut incorrectly. For quick identification, however, the various nut sizes are stamped on the bridge-piece, as shown. Another rack can be provided for square nuts, or additional holes and rods added to the same rack.

Quick Method for Setting Lathe Tool at Center Line of Spindle

By STANLEY P. GOULD, Porterville, Calif.

For most turning operations, especially taper-turning and single-point thread-cutting, it is desirable to have the cutting edge of the tool bit set at the center line of the lathe spindle. A simple method for insuring this setting employs a standard steel rule, as shown in the illustration.

The lathe should be set up for the operation with the work-piece held either between centers or in a chuck and the tool bit set by eye to approximately the correct height. A steel rule *A* is then held flat against the side of the work-piece *B* and the cross-slide advanced so that the rule is pinned against the work by the tool bit *C*. If the top of the rule leans toward the toolpost, it indicates that the cutting edge is set too low—as shown at view X in the illustration. A tool bit set too high on the work will force the rule to assume the position shown at Y where it leans away from the toolpost. If the cutting edge is correctly situated on the center line of the spindle, the rule will be perpendicular to the lathe bed, as seen at Z.



A standard steel rule is used to check the setting of cutting tool at center line of spindle.

Calculating Dimensions of a Cone Frustrum for a Given Volume

By William Rosenberg

THE usual formula for the volume of a frustrum of a cone given in various handbooks is

$$V = \frac{\pi H(R^2 + Rr + r^2)}{3} \qquad (1)$$

This formula can be used to determine the volume V from the known dimensions H, R, and r shown in the accompanying diagram.

There are occasions, however, where the volume and some of the dimensions of the frustrum are known and it is required to determine the remaining dimensions in terms of the volume and the known dimensions. One such problem, of frequent occurrence in design work, may be stated as follows: Given a cone frustrum of volume V, radius r, and slant angle A, find the large radius R and the height H.

The common approach to this problem is to substitute in Formula (1) for the unknown radius R in terms of the known radius r and angle A and thus obtain the following cubic equation in H:

$$\frac{\pi H^3 \tan^2 A}{3} + \pi r H^2 \tan A + \pi r^2 H = V \qquad (2)$$

The solution of this cubic equation to find H is tedious even by the best of methods, and can be avoided by using relatively simple formulas derived as follows:

From the diagram it can be seen that

$$H = \frac{R - r}{\tan A} \qquad (3)$$

Substituting this value for H in Formula (1),

$$V = \frac{\pi}{3}\left(\frac{R - r}{\tan A}\right)\left(R^2 + Rr + r^2\right)$$

$$= \frac{\pi}{3 \tan A}\left(R^3 - r^3\right) \qquad (4)$$

Solving (4) for R,

$$R = \sqrt[3]{\frac{3V \tan A}{\pi} + r^3} \qquad (5)$$

Having determined R from Formula (5), H can be determined by using Formula (3).

If r were the unknown radius instead of R, then by transposing Formula (4),

$$r = \sqrt[3]{R^3 - \frac{3V \tan A}{\pi}} \qquad (6)$$

Example: A 10-cubic inch container in the shape of the frustrum of a cone is to be of 1-inch radius at the small end and is to have a slant angle of 30 degrees. What should be the height of the container and the radius at the large end?

Using Formula (5),

$$R = \sqrt[3]{\frac{3 \times 10 \times \tan 30^\circ}{3.1416} + 1^3} = 1.87 \text{ inches}$$

Using Formula (3)

$$H = \frac{1.87 - 1}{\tan 30^\circ} = \frac{1.87 - 1}{0.577} = 1.51 \text{ inches}$$

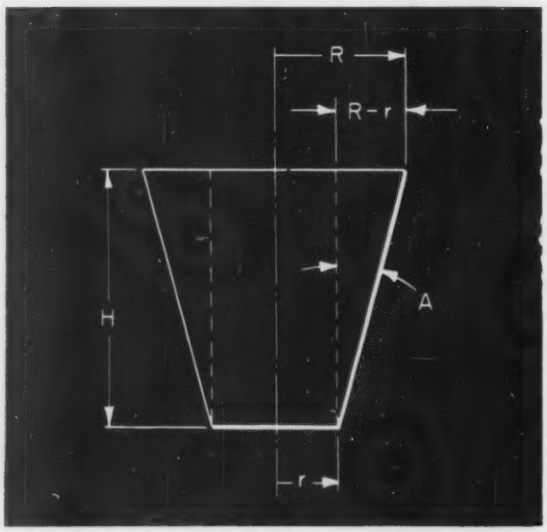


Diagram of cone frustrum showing dimensions required to develop Formula (1)

* * *

Record Stainless Steel Production in United States

United States production of all types of stainless and heat-resisting steels during 1953 exceeded 1,000,000 ingot tons, a record annual volume. About 40 per cent of this was composed of nickel-bearing grades which consumed some 45,000,000 pounds of nickel.



The Sales Engineer and His Problems

By BERNARD LESTER
Management Consulting Engineer
New York

Offensive Versus Defensive Selling

MY old Scottish friend, a salesman of woolens, constantly made distant trips in his twenty-year-old car in search of some bargain. While driving with him one day, I ventured concern over the way his car rattled. "I know it's noisy," he replied, "but it saves the horn."

Buyers and sellers alike confuse first cost and ultimate value. A low price attracts buyers, but it may be just "saving the horn." High prices frighten sellers because they think, "Now I am on the defensive."

Most buyers do pay some attention to value. You and I wouldn't buy the lowest priced shirt or golf ball. The prospect's objection to a high price is obscured by a false face—"That costs too much" really means "I'm not convinced that the results would justify your price."

When the intelligent and persistent sales engineer meets the hurdle of higher price (assuming the potential value justifies it), he faces a real opportunity. He cannot successfully meet this opportunity by being on the defensive, prefacing each sales appeal by the word *but*. Instead, he adopts an offensive approach, explaining step by step why his price is necessarily higher and proving that the ultimate value will outweigh the first cost differential. Except when a contract must go to the lowest bidder based on a fixed specification, the higher price presents a clean-cut opportunity to emphasize benefits to the purchaser.

Every buyer, in a hazy way, acknowledges that he gets what he pays for, but he does not always fully visualize the hidden values of the object he buys. Sales managers frequently fail because they do not train their sales engineers to aggressively sell all the added values. Conversely, sales engineers—especially the hasty or nonchalant ones—often fail to book orders just because they don't knock down the so-called "price advantage" from its pedestal and in its place erect the "true value advantage."

The solution is to get away from the idea of the packaged product as such. When we let our prospects mentally picture our equipment as one machine in a row among others, we immediately encourage him to judge ours by its price tag. But price provides an all too ready basis of comparison.

Sales engineers should use their skill to show that what they sell will yield the maximum result. In so doing, they depart from the product itself and draw the attention of the buyer to the engineering behind the product. Other considerations to be emphasized to the prospective customer are ease of machinery installation and time saved by the expert help that would be provided in getting things running right. These are distinct expense-saving values.

Sell the prospect the real values that accrue from the stability of your company as a supplier. Bundled up in his purchase are the performance reputation, fair and liberal policies, and financial responsibility of your company. In short, sell the value of character and integrity.

Perhaps the most nebulous value of equipment is pride of possession. Every day we see evidence of pride in the purchase of certain branded merchandise. Somehow product-brand selection is presumed to show superior discretion, wisdom, and even social standing. Every experienced sales engineer without bluster or brag learns to adroitly establish pride in the customer's mind from possible possession of his equipment.

Capable sales engineers don't meet higher price defensively. They adopt an *offensive* approach to firmly establish how ridiculous it is to chug along in a rattling old-time, expense-hungry car just "to save the horn."

LATEST DEVELOPMENTS IN *Shop*

Colonial Automatic Drilling, Broaching, and Stamping Machine

Following the trend toward automation in the metal-working field, the Colonial Broach Co., Detroit, Mich., has developed a three-station machine, Fig. 1, which performs drilling, broaching and stamping operations in one continuous cycle. All three operations are performed by units grouped around the loading and indexing mechanisms of the machine.

A typical machining cycle on an automotive camshaft sprocket includes drilling one hole 0.2656 inch in diameter in the web of the sprocket at the first station, broaching a 0.1885- by 0.1905-inch keyway in the shaft hole at the second station, and stamping the timing mark on the sprocket at the last station.

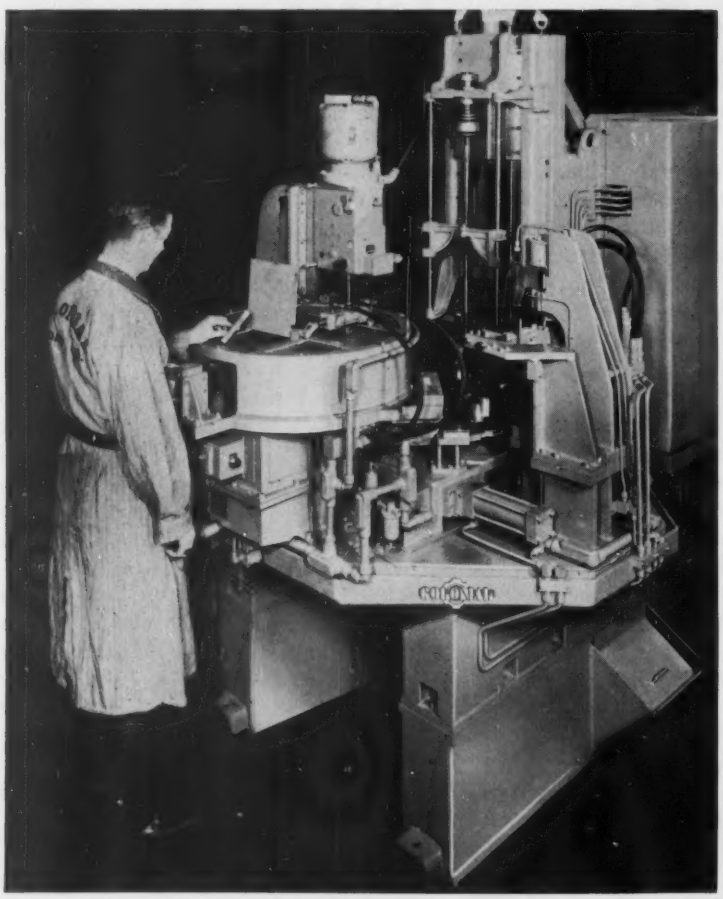


Fig. 1. Loading sprockets on the Colonial three-station machine which drills, broaches, and stamps these parts in one continuous automatic cycle

Locating guides are provided in the loading and indexing fixtures to make certain that each operation is performed in exactly the correct position with respect to the two other operations. Broaching is accomplished by a Colonial RD-624 pull-down broaching machine unit. A special hydraulically actuated unloader deposits the completed parts on a conveyor.

The outstanding feature of this machine is the table loading and indexing mechanism. The index-table is located off center and below the loading table. Parts are loaded—sprockets in this case—six at a time into circular holders on the ends of an oscillating loading arm seen in Fig. 2. Each holder contains an escapement mechanism which allows the sprockets to drop, one at a time, on the index-table. When the sixth sprocket drops, it actuates a switch which swings the arm around to a position where the empty holder is reloaded and the holder on the opposite end begins discharging parts into the chucks on the index-table.

The rotating index-table is hydraulically actuated. Around its periphery are four equally spaced chucks which receive and locate parts from the loading mechanism. A hole in the index-table between adjacent chucks allows the broaching tool to be returned following its working stroke. With this arrangement the table is indexed every 45 degrees.

In the application described, the machine performs the three different operations on the

For more information on these products, use Inquiry Card, page 243

Equipment

Machine tools, unit mechanisms, machine parts, and material-handling appliances recently placed on market

Edited by FREEMAN C. DUSTON

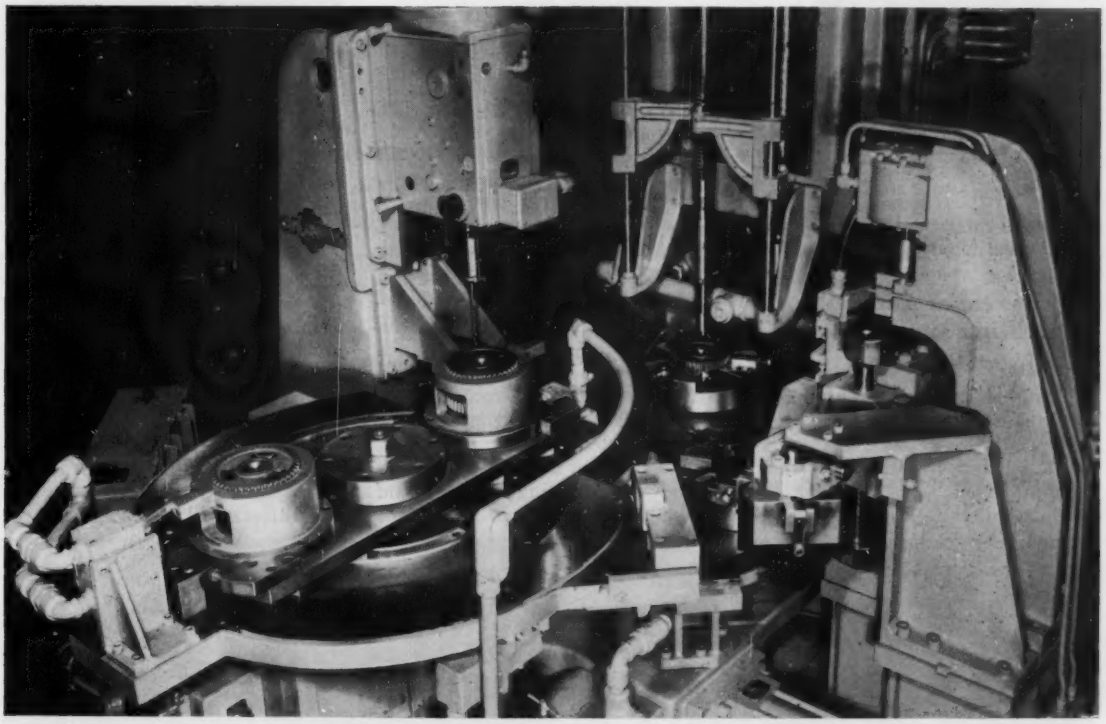


Fig. 2. Cover removed from machine illustrated in Fig. 1 to show how parts are manually loaded on holders at each end of a loading arm

sprockets, in addition to loading and unloading, on over 200 parts per hour. One 10-H.P. motor supplies the hydraulic power for loading, indexing, broaching, stamping, and unloading. All electrical and hydraulic circuits are designed according to J.I.C. standards and are interlocked to insure safe operation. 101

Oakite Aluminum and Steel Cleaner

An alkaline type material designed to clean aluminum, steel, and other metals in pressure-spray washing machines without objectionable foaming is being manufactured by Oakite Products, Inc., New York City. This cleaner is a white, free-flowing, powdered material known as Oakite Composition No. 161. It is completely soluble in water, free rinsing, and inhibited to prevent injury to aluminum. The anti-foaming properties of this material are also said to make it effective in the new, high-pressure spray-washing machines for cleaning steel and other metals.

Composition No. 161 is recommended for all pressure washing machine applications in the concentration of 1/2 ounce to 2 ounces per gallon, at temperatures ranging from 160 to 185 degrees F. The composition is simply added to warm water, then heated to the operating temperature, no boiling-in being required.

Extensive field tests have been conducted with the spray washing machines operating at both low and high pressures, using the new composition. These tests have consistently demonstrated the ability of this equipment to eliminate the troublesome foaming problems formerly encountered. 102

For more information on these products, use Inquiry Card, page 243



Cleereman automatic drilling and tapping machine

Cleereman Automatic Drilling and Tapping Machine

Two completely automatic, electromechanical drilling machines have been added to the line manufactured by the Cleereman Machine Tool Co., Chicago, Ill. Designated the "Series A" upright drilling and tapping machines, Model AD performs automatic drilling and Model ADT, automatic drilling and tapping operations. The general design makes the machines adaptable for complete automation and also for handling small-lot jobs.

The automatic cycle for the Model AD machine consists of power rapid traverse approach; feed; and power rapid traverse return. In addition to this cycle, the Model ADT has power rapid traverse approach; tap in; tap out; and rapid traverse return for the tapping operations.

Both machines have a speed range of approximately 60 to 1725 R.P.M. and a feed range from boring feeds of approximately 0.003 inch per revolution up through a full range of drilling and reaming feeds to 0.250 inch per revolution. All standard pitches for taps with leads up to 1/4-inch pitch are available. Regular equipment includes a 10-H.P. drive and No. 5 Morse taper spindle. Flanged spindles of various designs for multiple-spindle heads can be supplied. Antifriction bearings are used throughout with automatic lubrication to transmissions.

Single- and multiple-spindle models are available. The standard top section unit can be furnished alone for mounting on special fixtures, transfer machines, dial units, and similar special applications. 103

Motch & Merryweather Automatic Grinder

An automatic machine for grinding the spherical heads of automotive valve tappets at a production rate of approximately 4000 pieces per hour has been announced by the Motch & Merryweather Machinery Co., Cleveland, Ohio. The tappets are fed from a hopper into a double track device which loads them, two at a time, into fixtures on the continuously rotating table of the machine.

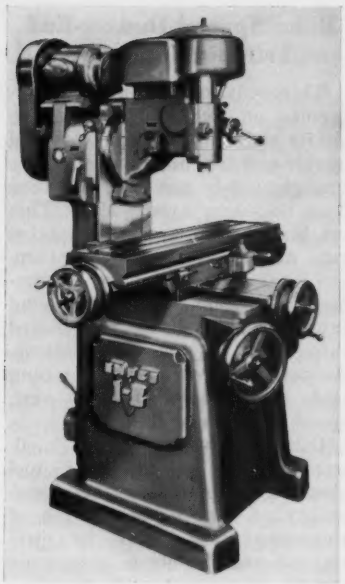
The rotating table has 160 individual work-holding fixtures and its radius corresponds to that of the spherical surface ground on the valve tappet heads by the four grinding wheels.

The continuous clockwise rotation of the table passes the tappets across the faces of these grinding wheels so that each wheel grinds off a portion of the 0.015 inch of stock removed from the work. The fourth head is provided with a special grinding wheel which gives a finish of approximately 10 micro-inches r.m.s. After being finish-ground, the tappets are automatically ejected. ... 104



Automatic grinder for finishing tappet valve heads, built by the Motch & Merryweather Machinery Co.

For more information on these products, use Inquiry Card, page 243



Vertical miller built by Industrial Metal Products Corporation

Ram Type Vertical Milling Machine

A Model 1-B vertical miller adapted for both production and tool-room milling is being manufactured by the Industrial Metal Products Corporation, Lansing, Mich. A unique feature of this machine is that the head can be adjusted vertically by a counterbalanced ram. Accuracy and rigidity are claimed because of the large scraped ram bearing surface.

The table has a working surface 10 by 40 inches, maximum longitudinal movement of 24 inches, and crosswise movement of 12 inches. The height from the table to the spindle nose ranges from 4 1/8 to 18 1/4 inches. The spindle quill has a diameter of 3 1/2 inches and a travel range of 5 inches. Speeds range from 75 to 300 R.P.M. 105

Snyder Automatic Transfer Machine for Processing Automotive Engine Part

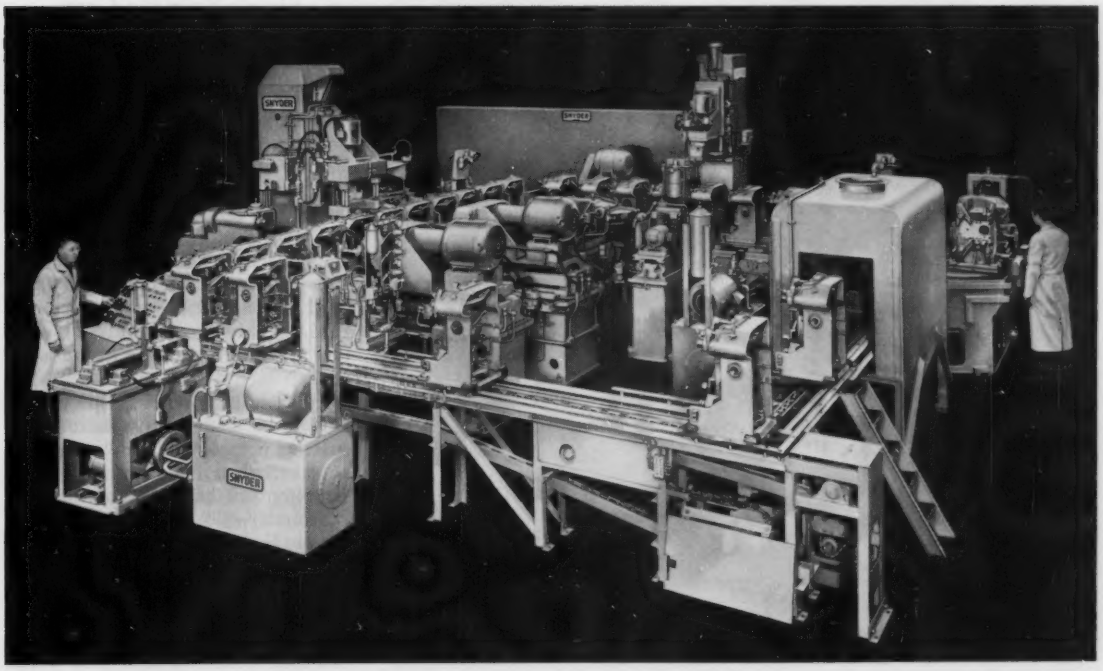
An eighteen-station, automatic transfer machine that processes front-end covers for automotive engines at the rate of one every twenty seconds has been announced by the Snyder Tool & Engineering Co., Detroit, Mich. The work-piece handled on this machine is a cast-iron housing that weighs approximately 35 pounds. With the exception of three ground faces necessary for locating purposes, all operations are performed upon the four faces and top of the part within the eighteen-station operating cycle of this machine. The part is delivered at the unloading station ready for assembly into the engine. Operations include milling, drilling, boring, counterboring, countersinking, and tapping.

Standard tap units and way type, hydraulic feed units are used. Milling cutters are held in Ericson collets and may be gaged and pre-set. All tools can be sharpened and pre-set so that when a tool change is necessary, no adjustment on the machine is required. Tools can be stacked in racks close to the stations in which they are to be used.

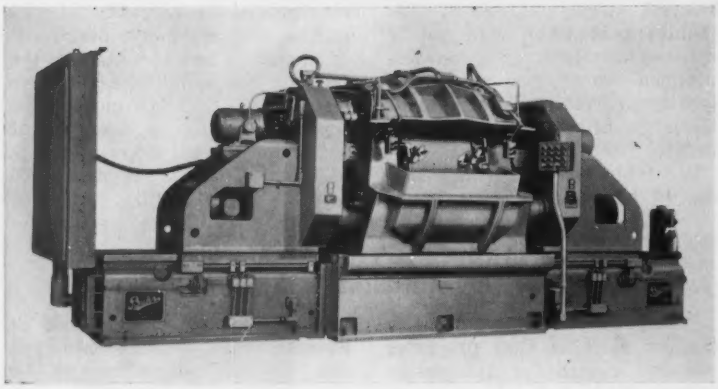
The machine is completely interlocked, can be operated by unskilled help, and requires a floor space approximately 35 by 22 feet. Lubrication is automatic, and chips are removed on conveyors. The total power requirement is 105 H.P. 106

Ex-Cell-O Heat-Treated Jig Bushings

Drill jig bushings made of special material and subjected to automatic, atmosphere-controlled heat-



Automatic transfer machine for processing automotive engine part has been built by the Snyder Tool & Engineering Co.



Special machine for processing two rear axle drive-shafts at the same time was recently announced by the Buhr Machine Tool Co.

treatment to obtain maximum wear resistance are being manufactured by the Ex-Cell-O Co., Detroit, Mich. The material used for these bushings is a high-chromium, high-carbon, oil-hardening bearing steel. Automatic controls governing furnace temperature, length of time in furnace, quenching, and temperature of quenching oil are said to give this material increased depth of hardness, toughness, strength, and uniformity. 107



Single-spindle high-speed gear hobbing machine introduced by the Morey Machinery Co., Inc.

Buhr Special Double-End Trunnion Machine

Thirty-six operations are performed on two rear axle drive-shafts simultaneously in a special double-end trunnion type machine brought out by the Buhr Machine Tool Co., Ann Arbor, Mich. This machine has a gross production rate of 328 pieces an hour. Operations include drilling, chamfering both ends of holes, and tapping. Two shafts are loaded into each of the six stations. Automatic hydraulic clamping and unclamping of the work speed up the production.

Other features include hardened-and-ground laminated tool steel ways; complete interchangeability of parts; and location of component assemblies by precision-bored dowels to insure accurate alignment. All multiple heads are of ball-bearing construction with shaved gears and broached and splined drives. Tapping spindles are of the lead-screw type and have precision-ground, hard chromium-plated threads. The automatic indexing mechanism is electrically controlled. It is of the cam and roller type designed to assure uniform acceleration and deceleration of the indexing movement. 108

Single-Spindle Gear Hobbing Machine

The Morey Machinery Co., Inc., New York City, is introducing a new single-spindle "Hydrax" gear hobbing machine built by David Brown Machine Tools, Ltd., England. This machine is designed for the rapid production of spur and helical gears by either climb or conventional hobbing. It has a fully automatic cutting cycle operated by one push-button, and the feeds are hydraulically controlled and steplessly variable at rates up to 1/8 inch per revolution of the work. The high cutting speeds are said to be achieved by means of a cutting principle which permits a shorter hob travel than is possible with conventional designs.

Hobs from 2 1/2 to 7 inches in diameter, up to 7 inches in width and up to 3 diametral pitch, can be used, and the hob spindle can be run at speeds ranging from 84 to 600 R.P.M. The machine will cut spur gears up to a face width of 10 inches and a diameter of 14 inches with a hob 3 inches in diameter. 109

For more information on these products, use Inquiry Card, page 243

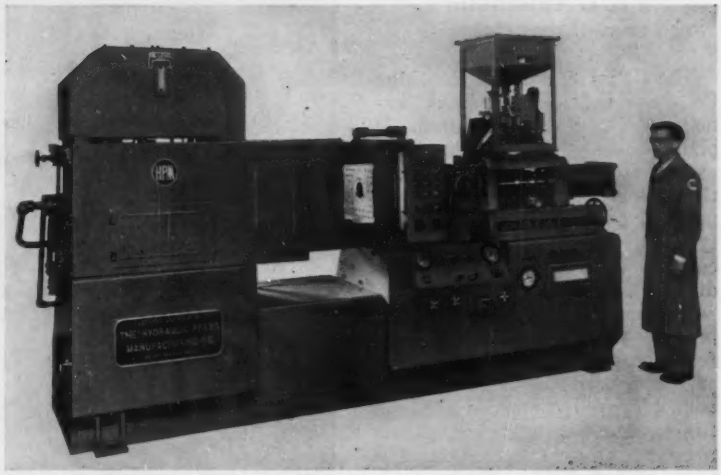
H-P-M Automatic Plastic Injection Molding Machine

The Hydraulic Press Mfg. Co., Mount Gilead, Ohio, has announced a fully automatic 6- to 8-ounce capacity injection molding machine. One attendant can operate from four to six of these machines at cycling speeds up to 400 times an hour.

This machine was developed primarily for industries using thin-walled containers for packaging ice cream and other dairy products. It is also adapted to the production of pharmaceutical containers, toys, lighting fixtures and small electronic parts for the radio-television industry. It has sufficient mold mounting space to accommodate multiple type molds.

The straight-line full-hydraulic mold clamp with fast opening and closing speeds has provisions for automatic slow-downs prior to mold contact, at mold breakaway, and during ejection of work.

The maximum mold clamp capacity is 150 tons. The daylight opening is 20 inches, clamp travel 10 inches, and maximum mold mounting space 15 by 20 1/2 inches. The machine is equipped with a 20 H.P. motor and weighs 14,500 pounds. 110



Automatic injection molding machine built by Hydraulic Press Mfg. Co.

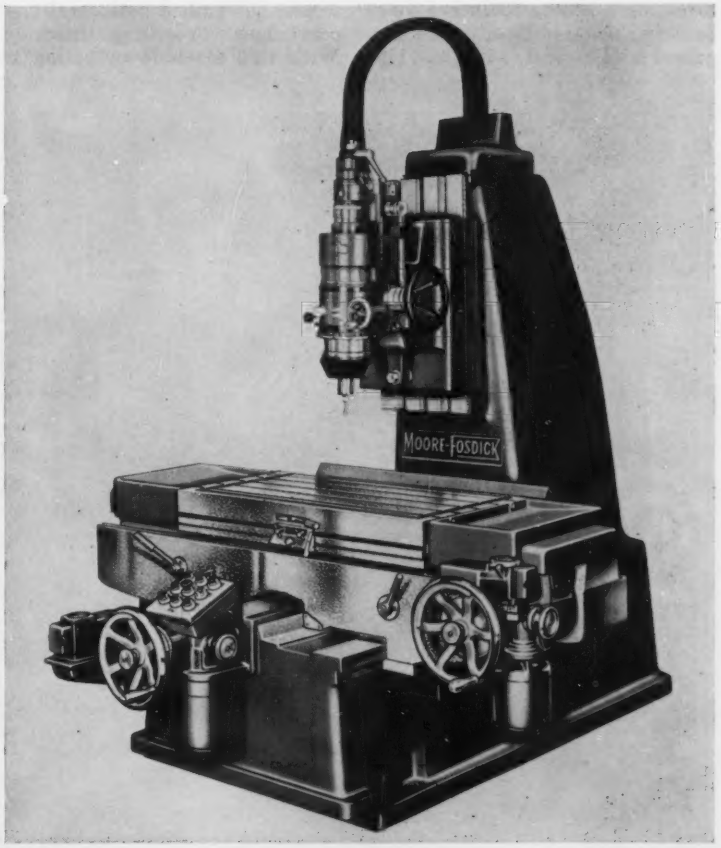
Moore-Fosdick Jig Grinder

The Fosdick Machine Tool Co., Cincinnati, Ohio, has just introduced the Moore-Fosdick jig grinder, a combination of the Moore planetary motion jig grinding head with the Fosdick automatic positioning table, thus making possible a wider range of applications. The table positions work within limits of plus or minus 0.0001 inch.

One of the outstanding features of this machine is its ability to grind cylindrical as well as tapered holes. An angular and indexing device built into the main spindle and a newly developed slot grinding attachment permit quick, accurate grinding of any regular or irregular contour.

Grinding speeds of from 12,000 to 60,000 R.P.M. allow accurate control of stock removal. Work of any size up to 22 by 42 by 27 inches can readily be handled on the machine. There are four spindle speeds—90, 120, 180, and 240 R.P.M. Spindle feeds are obtained by air-powered hydraulic control. The main spindle has a travel range of 3 5/8 inches on the slide and can be adjusted within a range of 1 1/2 degrees either way for taper-boring up to an included angle of 3 degrees.

Standard equipment includes a four-speed, constant-torque, 1/4-H.P. motor; micrometers; and end measures. The grinder is now available in three models with tables 18 by 36 inches, 22 by 44 inches, and 22 by 44 inches with automatic machinery. 111

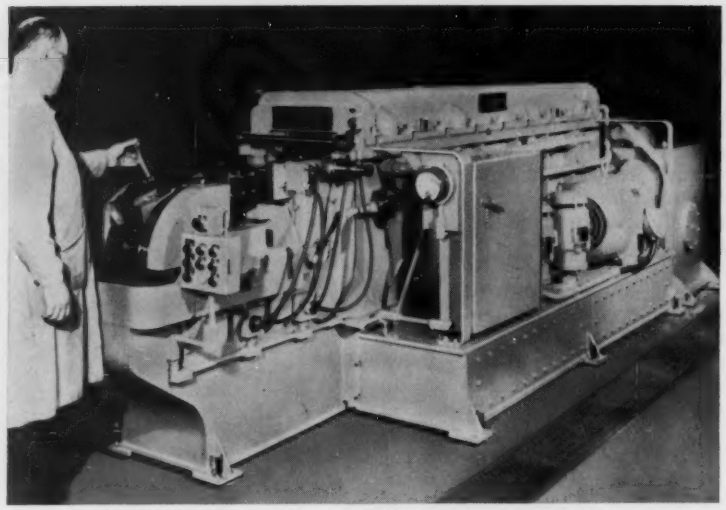


Moore-Fosdick jig grinder, combining advantages of Moore jig grinding head with work-locating accuracy of Fosdick automatic positioning table

J & L Automatic Plunge-Form Grinder

The Jones & Lamson Machine Co., Springfield, Vt., has announced a Model E automatic plunge-form grinder designed for extremely accurate, high-production work. This machine can be used for chucking, center, or shoe type grinding. The wheel can be conditioned by crush-forming or diamond truing.

The completely automatic cycle provides high-speed approach, feed, spark-out, and withdrawal of the wheel. The positively controlled cycle is obtained through simple cam action which insures constant, uniform operation. The wheel-slide is held against a positive stop by uniform hydraulic pressure, providing automatic, positive size control. The automatic truing arrangement provides for wheel dressing after every piece or after any predetermined number of pieces. Work up to 13 inches in diameter will swing over the table. The machine can be furnished to take pieces up to either 7 1/2 or 32 inches long between centers. Floor space required is 44 by 78 1/4 inches. .112



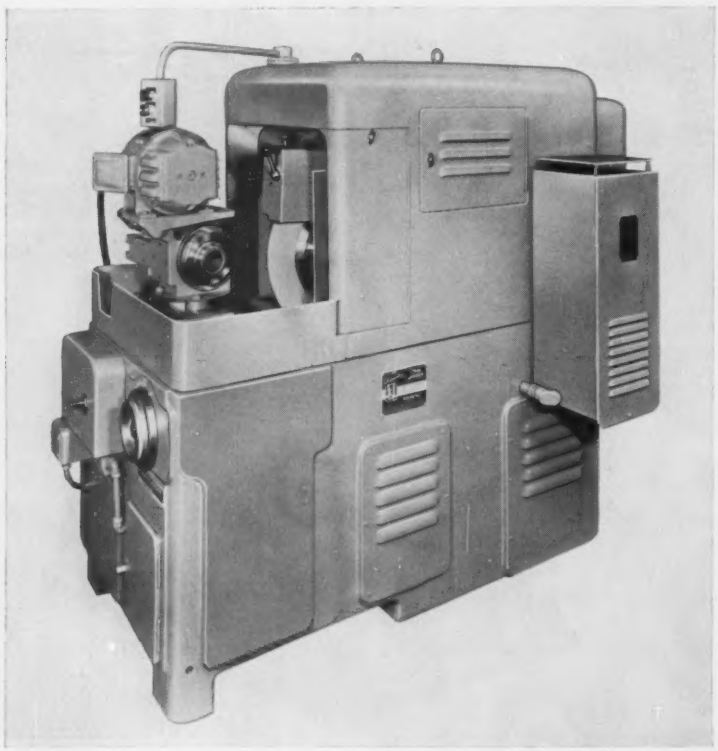
Continuous broaching machine for high-speed processing of connecting-rods built by the Lapointe Machine Tool Co.

Lapointe Continuous Broaching Machine

To meet the ever-increasing demand for broaching parts at higher production rates, the Lapointe Machine Tool Co., Hudson, Mass., has built a horizontal type continuous broaching machine. With this machine operating at minimum speed, a production rate of 900 parts per hour can be obtained in broaching the sides, face, and half-round surface of an automotive connecting-rod. When operating at top speed, this machine doubles the output. These parts are of the customary steel forging material, from which the machine removes stock to a depth of approximately 1/8 inch on each broached surface.

Built with a stroke of 120 inches, the machine is driven by a 30-H.P. motor. It has been designed with a series of individual, self-operating, self-locating, and self-clamping fixtures so arranged that the operator merely has to insert the parts into the work nests. The machine has twenty self-operating fixtures and is said to be fool-proof, stopping automatically upon interference with its normal operation.

The drive-chain which carries the work-pieces past the stationary broaches runs over 12- and 16-inch double roller bearings. Fixtures operate through lateral guides, and the drive sprockets are so designed that they can be renewed or replaced without removing the drive-chains. A broach-carrying bridge on top of the machine swings open easily for changing broaches. It will accommodate the main broach assemblies of any type within the capacity of the machine and can be supplied with an electric hoist assembly to facilitate removal of the broaches.



Jones & Lamson automatic plunge-form grinder of compact design

For more information on these products, use Inquiry Card, page 243

The machine has a conveyor attachment for chip removal. Coolant is furnished by two coolant pumps—one supplies coolant to the broaches at the top of the machine, and the other is used in connection with the chip removal trough. 113

Automatic Gear-Shaving, Inspecting, and Sorting Machine

Complete automation of a machine that shaves, inspects, and sorts spur or helical gears at high production rates is now available from the National Broach & Machine Co., Detroit Mich. This is essentially a standard diagonal type Red Ring rotary gear-shaving machine, equipped with a discharge belt conveyor unit, vibrating hopper, and straight-line feeder, automatic "in" and "out" gages, and an automatic loader. The gages are arranged to shut down the machine if it either receives or produces too many reject parts. When this occurs, signal lights show the set-up man quickly what is wrong, thus cutting machine "down" time.

Finish-shaved gears are automatically unloaded from the machine and fed through an "out" gage that checks the parts for size and helix angle accuracy. Gears passing this rigid final inspection test are deposited on a small conveyor belt which carries them to the main conveyor line. The unit occupies a floor space about 8 by 9 1/2 feet. 114

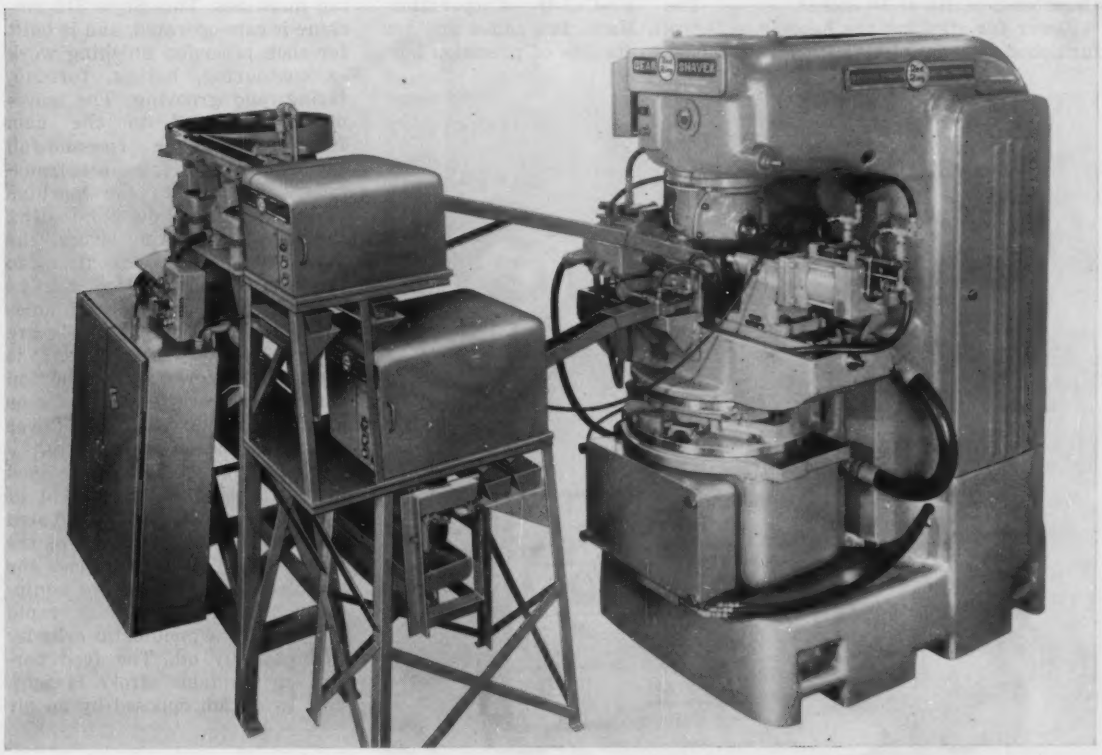
Scherr Small-Parts Comparator

George Scherr Optical Tools, Inc., New York City, announces the development of an optical comparator for the production inspection of small, odd-shaped parts used in the instrument, business machine, typewriter, electronic, watch, and similar industries. This Model C comparator is designed to permit 100 per cent optical inspection of small work-pieces against an enlarged drawing.

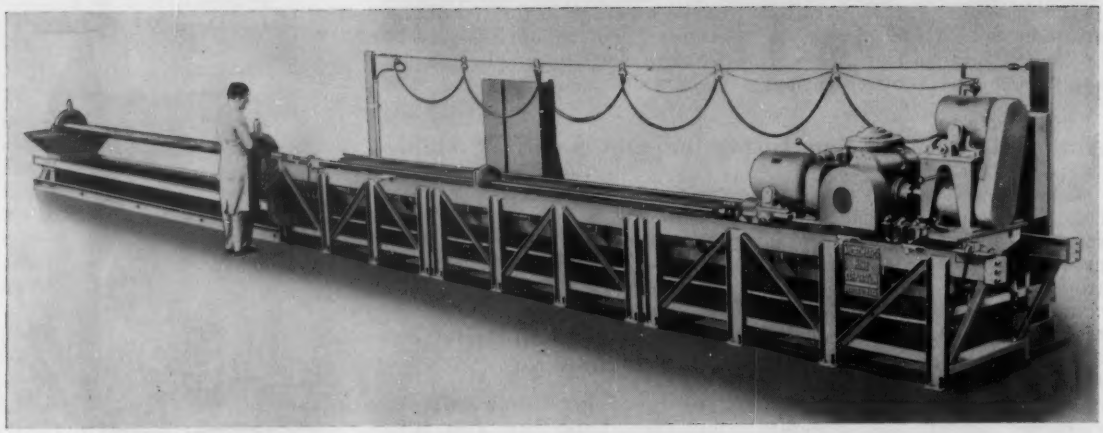
The horizontal work stage and vertical beam of light permit many parts to be simply laid flat on the stage without using holding fixtures. The instrument can be used to advantage for delicate assembly operations, since the unreversed image gives the operator a normal view of his movements on the screen. The instrument is portable and is equipped with one fixed magnification lens which may be a 20X, 25X, 31 1/4X, or 62 1/2X. 115



Comparator for inspection of small parts recently announced by George Scherr Optical Tools, Inc.



Red Ring fully automatic gear-shaving production unit made by the National Broach & Machine Co.



Long-stroking honing machine brought out by the Micromatic Hone Corporation

Micromatic Long-Stroke Honing Machine

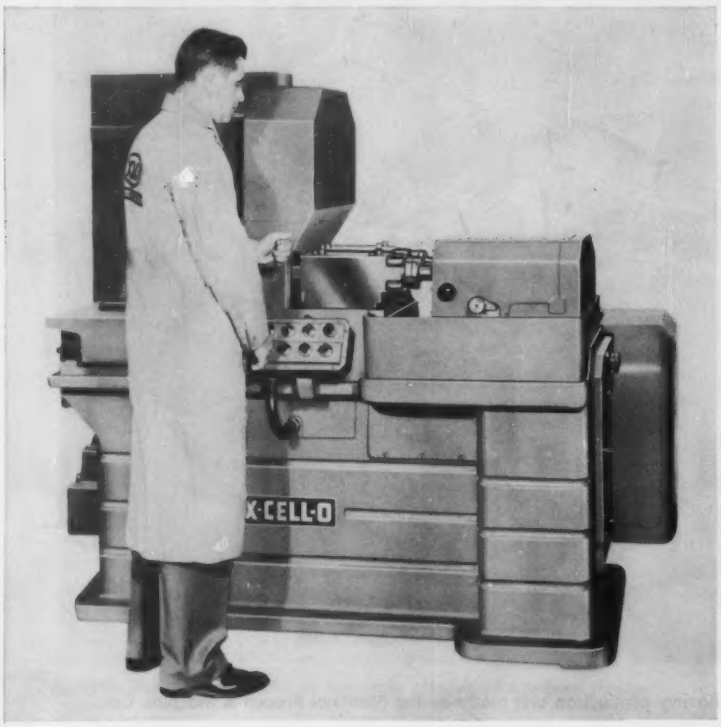
For production honing parts that have exceptionally long bores, the Micromatic Hone Corporation, Detroit, Mich., has brought out a series of horizontal Microhoning machines, designed to supply the power and speeds required for rapid and heavy stock removal. Machines in this No. 6000 series may be built for any stroke length over 5 feet. The machine shown has a 20-foot stroke and a diameter capacity of 10 inches.

Power for stroking the head is furnished by an electric motor with a clutch arrangement for reversing the direction of the stroke. The head rides on two rails and is mechanically reciprocated by a gear and rack arrangement. Seven combinations of spindle speeds ranging from 44 to 350 R.P.M. are available on the machine shown. The maximum reciprocation speed is 60 surface feet per minute. The tool is mechanically expanded through a "Hydrobrake" adjusting head, which permits the operator to regulate the abrasive feed-out and to control the size of the finished bore. Pressure on the abrasive can be increased while the machine is stroking by means of a hand-lever on the head. . .116

Ex-Cell-O Precision Boring Machine

The Ex-Cell-O Corporation, Detroit, Mich., has added another model to its line of precision boring machines. This Style 312 machine is cam-operated, and is built for such precision finishing work as contouring, boring, turning, facing, and grooving. The movements imparted to the cam followers by the rise-and-fall segments of the cams are transmitted directly to the machine table and cross-slide, eliminating the use of connecting levers. The machine is designed essentially to accommodate parts that can be rotated on one or more spindles while the non-rotating tools are supported on the cross-slide. It is especially adapted for production contouring work in which forms must be reproduced over and over again within close tolerances.

The contour form is obtained by the longitudinal movement of the machine table coordinated with the lateral movement of the cross-slide. The table carries the spindles with their drive equipment and is operated in rapid traverse by a pneumatic cylinder cushioned by oil. The feed portion of the table stroke is actuated by a cam opposed by an air



Precision boring machine brought out by the Ex-Cell-O Corporation

For more information on these products, use Inquiry Card, page 243

cylinder. All cross-slide movements are actuated.

Cams are hardened and ground, and are engaged by felt oil wicks to maintain a film of lubricant. Followers are tipped with tungsten carbide. The whole cam assembly is hinged so that it can be swung out of its compartment for changing cams. Both the machine table and the cross-slide are supported on flame-hardened ways, fitted with gibs for stability. Oil is automatically delivered to the ways during each work cycle. Between the table and the cross-slide is a chip chute that is cast integral with the base. 117

"Electromill" Equipped for Boring, Drilling, and Milling

Work-pieces as large as 30 by 48 inches and weighing up to 5000 pounds can be bored, drilled, or milled in the "Electromill," a machine built by the W. B. Knight Machinery Co., St. Louis, Mo. Setting up, clamping, inspecting, and machining operations are said to be easily performed on this vertical type machine. All controls are located in a single panel that can be moved to the most convenient position. Both the spindle speed and feed can be changed without stopping the spindle.

Variable-speed motors, equipped with "Thymotrol" control, offer a range of infinitely variable speeds and feeds. A throat capacity of 35 inches permits handling large work 118

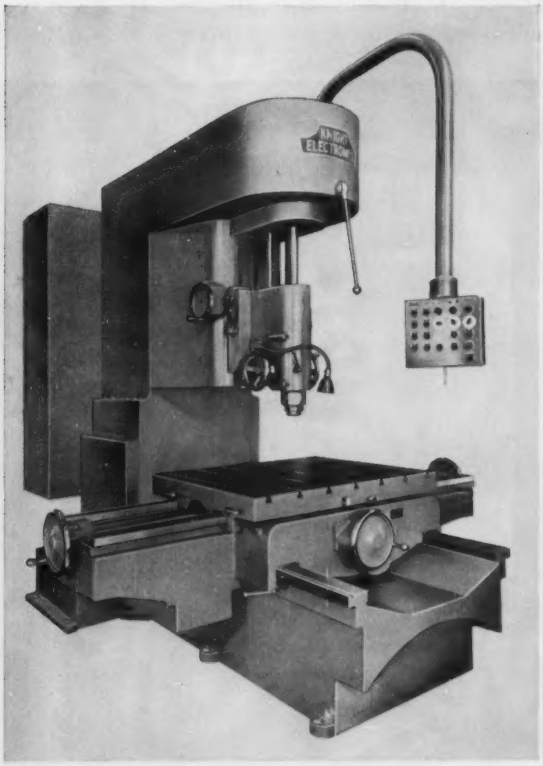
Fellows Gear Shaper of 6-Inch Capacity

A gear shaper, designated No. 4GS, has recently been placed on the market by the Fellows Gear Shaper Co., Springfield, Vt. This machine will produce external and internal spur and helical gears with pitch diameters up to 6 inches and face widths up to 2 inches. The maximum diametral pitch is 5/7 for spur gears, and 6 for helical gears.

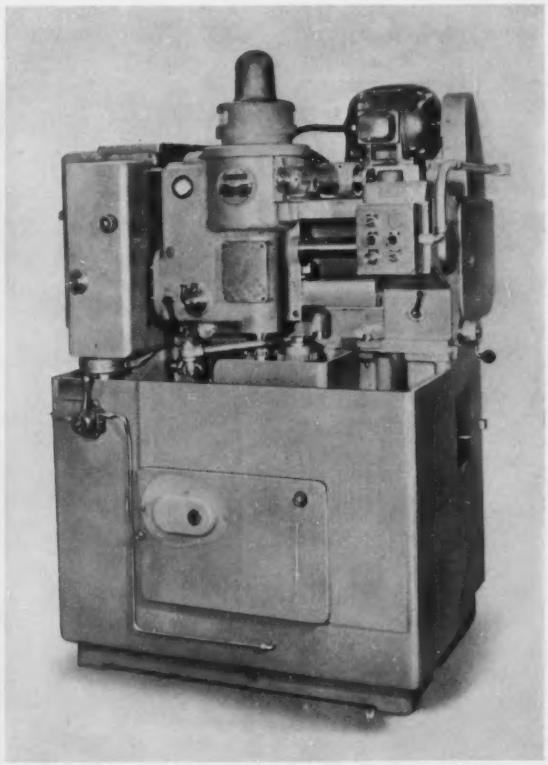
A cutter with a pitch diameter of 4 inches is mounted on a cutter-spindle 3 3/8 inches in diameter which is reciprocated through a 2 1/2-inch rock-shaft driven from a crankshaft. The drive to the crankshaft from the main drive-shaft is through a pair of pick-off gears which can be changed to give cutter-spindle speeds ranging from 98 to 635 strokes per minute. The main drive-shaft is driven through a Gilmer belt by a 1 1/2-H.P. motor running at a speed of 1200 R.P.M.

The rotary feed of cutter and work is also governed by pick-off gears which provide feeds ranging from 0.008 to 0.024 inch per stroke of a cutter 4 inches in pitch diameter. The ratio of rotation determined by the relationship between the number of teeth in the work and the number of teeth in the cutter is maintained by compound change-gears.

Other features include an improved depth feed mechanism, an air-operated saddle return, a cam trip mechanism to automatically accelerate the withdrawal of the cutter from the work when the last tooth has been cut, a separate coolant pump and motor operated by a switch button. The gear shaper is particularly adapted for automatic work-loading and unloading arrangements. 119



"Electromill" introduced by W. B. Knight Machinery Co.



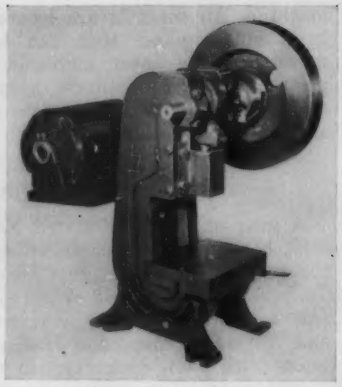
Fellows external and internal spur and helical gear shaper

For more information on these products, use Inquiry Card, page 243

Bendix Ultrasonic Cleaner

An ultrasonic cleaner for processed parts, which is said to save substantially costs of solvents and labor, is being brought out by the Pioneer-Central Division of the Bendix Aviation Corporation, Davenport, Iowa. The cleaner uses water-soluble detergents or cleaning solutions, employing the lower-frequency, magnetostrictive transducer to achieve high penetration of ultrasonic energy.

The unit operates by transmitting ultrasonic waves through the detergents or other cleaning solutions which surround the parts to be cleaned. The ultrasonic energy forces the solution to cavitate, or "cold-boil," with countless minute bubbles. These bubbles implode and literally blast particles of grease, grit, and other foreign matter loose—reaching the most inaccessible recesses of precision parts. Metals, glass, rubber, plastics, ceramics and other materials can thus be cleaned. The cleaner will be produced in three models having diameters of 4, 7 1/2, and 12 inches, each with a depth equal to its diameter. The illustration shows "before" and "after" examples of a fuel-metering pump body, which is typical of the complicated parts that the new system is designed to clean. 120



Press added to "Press-Rite" line of Sales Service Machine Tool Co.

Press with Heavy-Duty Inclinable Frame

A 2-ton Model No. 00 press has been added to the "Press-Rite" line of the Sales Service Machine Tool Co., St. Paul, Minn. This press is of heavy-duty construction, and is adapted for the production of small stampings, especially single pieces. It is also suited for use in the jewelry trade and for secondary or assembly operations.

A single-trip safety mechanism is provided as standard equipment but this can be quickly changed to permit continuous operation. The press has a standard 3/4-inch stroke but a 1-inch stroke is optional. Flywheel speed is 270 R.P.M. 121

Sheffield Automatic Welding Machines for Small Precision Work

Special machines for high-speed, low-cost automatic welding of precious and semiprecious metal contacts to leaf springs, small contact arms, and other instrument components are being manufactured by the Sheffield Corporation, Dayton, Ohio. Gold, silver, platinum, palladium, and iridium are some of the metals used for the welds. The point contacts vary in shape from a small pin point up to a dome shape 0.070 inch in diameter at the base with a height of 0.060 inch. Disc contacts of silver vary in diameter from 0.025 to 0.187 inch and from 0.005 to 0.040 inch in thickness, depending upon the diameter. Both disc and point type welding machines have a production rate of from 1200 to 2400 contacts per hour. The welding current is controlled with a Thyratron unit that assures uniform welds. 122



Bendix ultrasonic cleaning equipment and work example

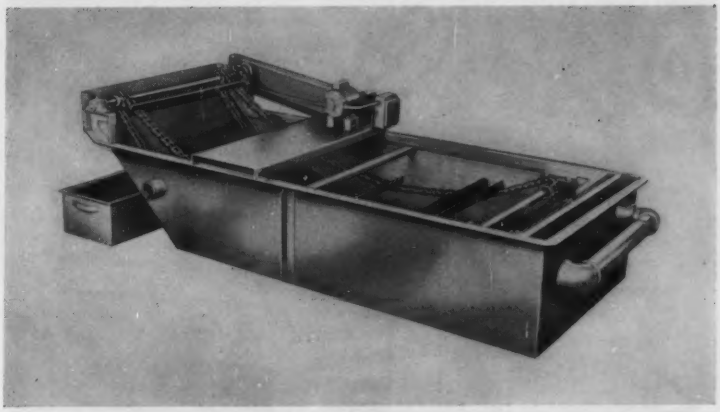


Sheffield machine for welding metal contacts to parts

For more information on these products, use Inquiry Card, page 243

Delpark Settling and Filtering Unit

A settling and filtering unit that permits continuous removal of chips, heavy solids, and relatively fine solids down to 0.004-inch screen size has been announced by the Industrial Filtration Co., Lebanon, Ind. This unit is made for the filtration of liquids of varying degrees of viscosity containing solids of different particle sizes and widely differing weights. The system operates on the principle of expelling settled solids with chain-driven flights. This reduces the volume of solids to be removed by the filter screens, which are continuously cleaned by brushes. 123



Delpark continuous settling and filtering unit

"Plastic Lead Seal" Available in Brush-Top Containers

"Plastic Lead Seal" pipe thread and gasket sealing compound, introduced by the Crane Packing Co., Chicago, Ill., is now available in handy-to-use 1-pound brush-top cans. This provides a permanent type applicator that does not require cleaning after use. The brush permits working the compound more thoroughly into the threads.

"Plastic Lead Seal" is a permanent, yet non-hardening pipe thread sealing compound which allows easy disassembly of fittings, even after years of service. It withstands pressures up to 6000 pounds per square inch, temperatures up to 500 degrees F., and is insoluble in water, steam, gas, and refrigerants, as well as all petroleum products. 124

Federal High-Speed Press with Conveyor Type Feed

A high-speed press featuring a conveyor type feed is being introduced by the Federal Press Co., Elkhart, Ind. This press, operated by only one man, is capable of producing up to 7200 pieces per hour. It is the standard OBI Model 44 press, equipped with a wide ram and bolster plate. A chain conveyor with nineteen pairs of stations, or a total of thirty-eight stations, is provided.

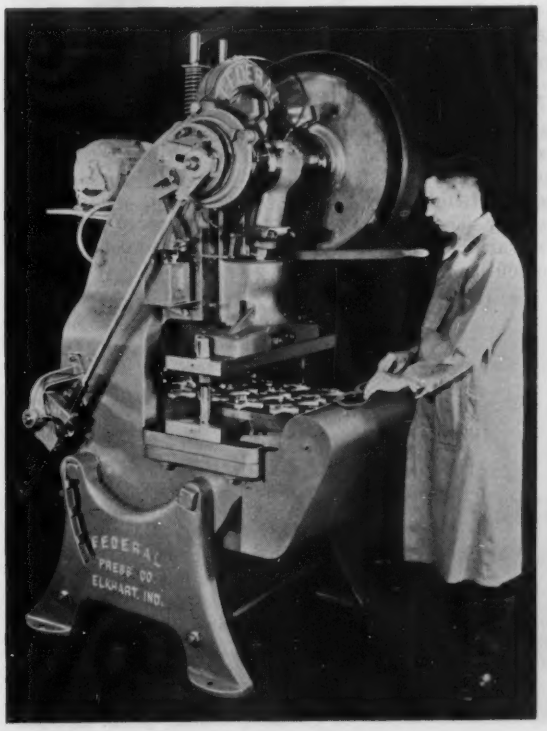


Fig. 1. High-speed press with conveyor type feed built by the Federal Press Co.

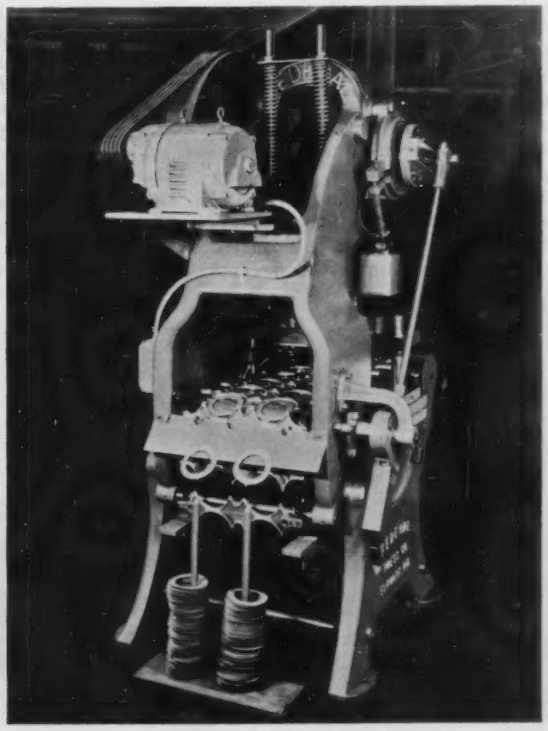


Fig. 2. Rear view of Federal press, Fig. 1, showing work being automatically ejected and stacked

For more information on these products, use Inquiry Card, page 243

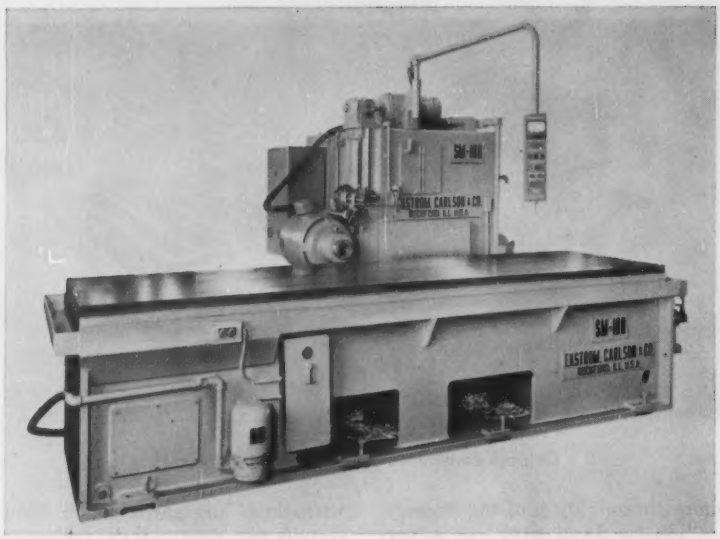


Fig. 1. Scarf- and edge-milling machine built by Ekstrom, Carlson & Co.

The safety stop mechanism of the press assures accurate alignment at each work station and also functions to stop the press in case of jamming or misalignment. Possible damage to equipment and dies is thus prevented. In feeding material to the conveyor, the operator works at a safe distance—approximately 2 feet—from the ram, as shown in Fig. 1. Stampings are automatically ejected from the conveyor and slide into containers or on stacking posts at the rear of the press, as shown in Fig. 2. 125

Ekstrom, Carlson Scarf-Milling Machine

Ekstrom, Carlson & Co., Rockford, Ill., have added a No. SM-100 open-side scarf- and edge-milling machine to their line of high-speed milling and routing machinery built for the aircraft industry. This machine is primarily intended for use in milling non-ferrous metals. A horizontal spindle head is mounted on a vertical column and can be adjusted to tilt a maximum of 30 degrees either above or below the center line. The spindle head is driven by a motor delivering 15 H.P. at 1800 R.P.M. or 30 H.P. at 3600 R.P.M. The spindle has a No. 50 standard milling machine taper.

The work-table surface is 36 by 144 inches, has three standard T-slots, and is located at a height of 36 inches from the floor. The vertical column has a variable feed ranging from 10 to 200 inches per minute, jog-dynamic braking, and rapid traverse. The work-table and the herringbone pinion rack are designed so that they can be extended at either or both ends. The machine is furnished with a pendant control having push-buttons for starting and stopping the spindle-head motor, rapid traverse of the column to either right or left, and a variable-feed rheostat. 126

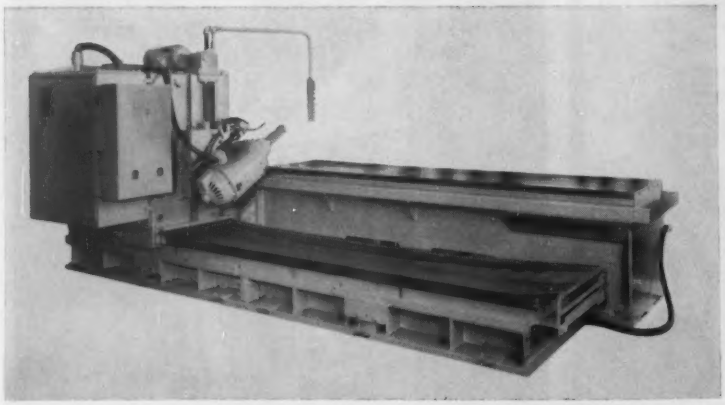


Fig. 2. Rear view of machine, with milling spindle in tilted position

Boyar-Schultz Surface Grinder

The 6- by 12-inch surface grinder made by the Boyar-Schultz Corporation, Chicago, Ill., is now available with hydraulic longitudinal feed. A new hydraulic valve, designed by the company's engineers, controls the reciprocating movement. Only a few seconds time is required to change from hydraulic to hand feed, or vice versa. 127



Boyar-Schultz surface grinder equipped with hydraulic feed

Selenium Power Rectifiers

The Walker Division of the Norma-Hoffmann Bearings Corporation Stamford, Conn., has announced a packaged line of selenium power rectifiers designed for both large and small power requirements. Efficiencies and power factors are high, and dependability and economy of operation are said to be exceptionally good. Applications are claimed to be practically trouble-free. 128

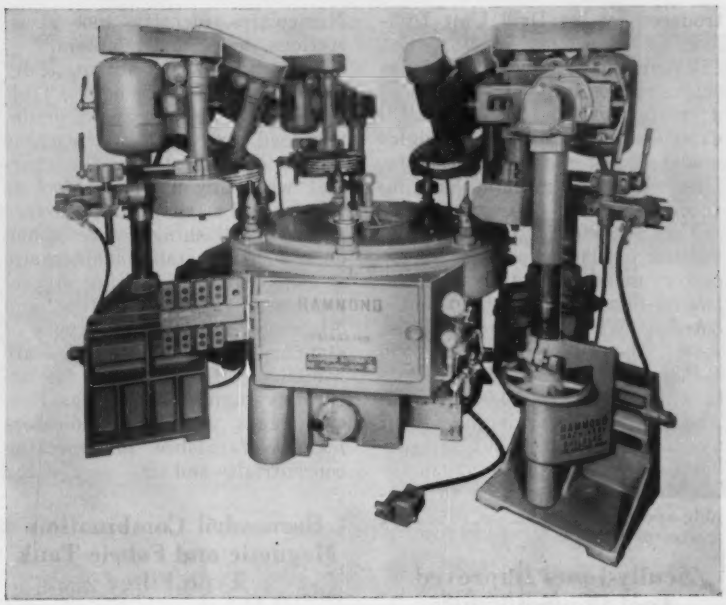
For more information on these products, use Inquiry Card, page 243

Rotary Automatic Polishing and Buffing Machine

A rotary, indexing type polishing and buffing machine that will accommodate up to six head and stand units is a recent development of Hammond Machinery Builders, Inc., Kalamazoo, Mich. This Model K-62-7 machine runs at a constant speed equivalent to one indexing movement a second and has an adjustable dwell period which gives an operating range of from 150 to 1700 indexes per hour. The indexing turret has an outside diameter of 62 inches.

The table is locked in each indexed position by a tapered bolt which is withdrawn prior to indexing by a cam on the lever shaft of the Geneva indexing mechanism. Table work-spindles are driven by a 3/4-H.P. motor and have a variable speed range of either 15 to 45 or 50 to 150 R.P.M. These spindles operate independently of the indexing mechanism.

There are seven work-spindles, six of which support and rotate the work at the wheel stations, while the seventh is located at the operator's loading station. ..129



Automatic indexing type polishing and buffing machine brought out by Hammond Machinery Builders

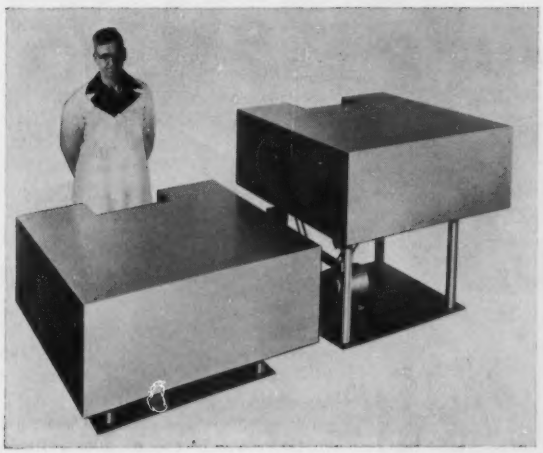
Portelvator for Lifting Heavy Work to Machine Feeding Level

In many machining jobs the manual transfer of material or units from one machine to another, or from the stock supply to the machine feeding level, presents problems. To facilitate such work-handling, the Hamilton Tool Co., Hamilton, Ohio, has developed the Portelvator pack lifter. This Portelvator is designed for pit installation and has a load lifting capacity of 2200 pounds. It will raise work 16 inches from the floor level at a speed of 27.5 inches per minute.

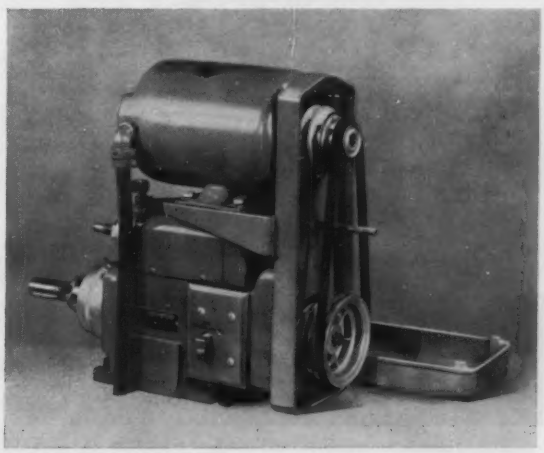
This lifter is operated by a 3/4-H.P. motor with push-button controlled reversing magnetic starter, and is equipped with a gear-driven limit switch. An operator station is provided on the long side of the 45- by 48-inch table. The apron extends 1 inch below floor level when the table top is at its maximum height. Power transmission is mechanical, through meshed worm, worm-gear, and screw, and neither mechanical failure nor power failure can cause the table to fall. Portelvator pack lifters are made in many sizes, and for manual or automatic operation. 130

Belt Drive for Rockwell Air-Hydraulic Drill Units

A V-belt drive arrangement for broadening the spindle speed range and versatility of its air-hydraulic drill units has been in-



Hamilton Portelvator lifts heavy work to feeding level



Rockwell standard drill unit equipped with V-belt drive

troduced by the Drill Unit Division of the Rockwell Mfg. Co., Pittsburgh, Pa. This accessory includes cast-iron pulley guards and a motor plate which accommodates standard NEMA rigid-mounted motors. The unit complies with J.I.C. machine building specifications.

Using standard four-step dynamically balanced pulleys, the accessory makes it possible to obtain twenty-four different spindle speeds. With an 1800-R.P.M. motor, the range is 590 to 5000 R.P.M.; with a 3450-R.P.M. motor, it is 1180 to 10,000 R.P.M. The drive can be ordered without the cast-iron motor plate for converting a face-mounted motor with fixed spindle speed to variable-speed operation. 131

Scully-Jones Improved Tool Control Panels

Special tool control panels with automatic counting and signaling devices, called "Toolitrols," are now being built by Scully-Jones & Co., Chicago, Ill. These panels are designed to coordinate the functions of pre-setting, storing, and changing cutting tools at the machine and are built to suit new or existing machine installation.

The sheet-metal cabinets are mounted on steel benches with hardwood tops. There is at least one station on the Toolitrol for each machine station and spindle. Nameplates identify tool sizes, stations, tools, and adapters.

Tool changes are automatically indicated by counters on the Toolitrols which are set for a predetermined number of machine cycles. A light signals the operator when any particular tool or tools should be changed. A surface plate with bushings to accommodate each adjustable adapter size is employed for adjusting or presetting drills, reamers, taps, and other cutting tools. Two types of standard Scully-Jones gages are available with Toolitrols for accurately gaging tool settings. Special gages with dial indicators may be furnished for checking concentricity and size. 132

Barnesdril Combination Magnetic and Fabric Tank Type Filter

Two principles used in conditioning soluble oil coolants and mineral cutting oils have been incorporated in a new type of filter announced by the Barnes Drill Co., Rockford, Ill. This compact unit, known as "Kleenall," combines the Barnesdril magnetic separator drum with a tank type filter in which the coolant passes through a fabric having the desired porosity.

Fabrics of different densities and types are available to give the degree of coolant clarity and rate of flow required. Many applications permit mounting the filter unit on top of the machine coolant sump. When such an arrangement is not practical, a coolant tank of sufficient capacity is supplied with the filter. For applications involving only non-ferrous metals, the magnetic drum is omitted. Four models are available, in capacities ranging from 15 to 60 gallons per minute. 133

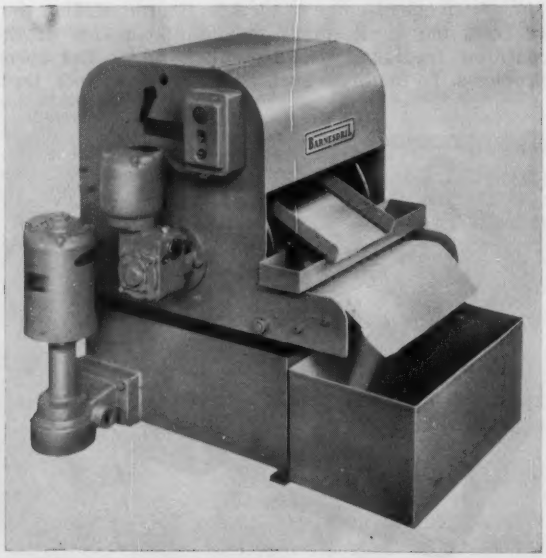
Lincoln Welder and Stand-by Power Unit

A low-cost combination welder and auxiliary, or stand-by, power unit for maintenance work, which features large capacity and simultaneous output of both welding and auxiliary current, has been developed by the Lincoln Electric Co., Cleveland, Ohio. This "Weldanpower" unit, as it is called, is rated as a 200-ampere welder and a 4-KVA continuous-duty power unit. For intermittent stand-by power, it is rated at 5 KVA.

The machine supplies a wide range of alternating current for maintenance welding in repairing equipment due to breakdowns, rebuilding worn parts, hard-facing machine parts to resist wear, making replacement parts, building special equipment, and many other uses. It supplies 230/115 volt, 60-cycle single-phase alternating-current stand-by power to operate grinders, drills, power tools, pumps, saws, and lights.

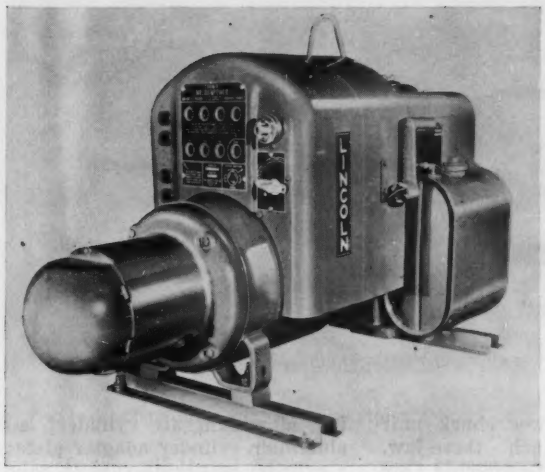


"Toolitrols," panels for coordinating the setting, storing, and changing of tools

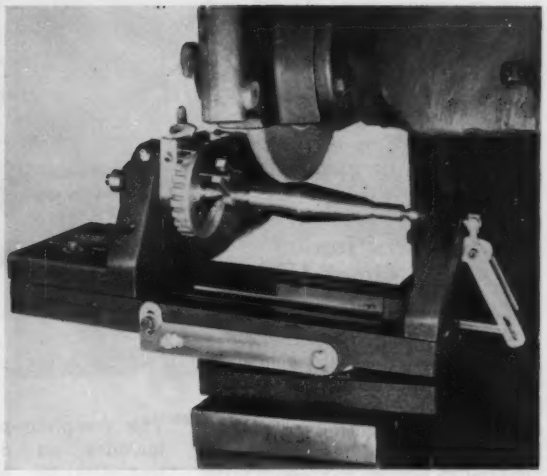


Combination magnetic and fabric type filter brought out by the Barnes Drill Co.

For more information on these products, use Inquiry Card, page 243



Lincoln "Weldanpower" welder and stand-by power unit



Surface grinder attachment that is set for taper-grinding

The unit consists of an alternating-current alternator powered by a 12-H.P. air-cooled gasoline engine. Accurate voltage control of output insures efficient operation of electrical equipment, and prevents both overvoltage and undervoltage. The operating panel provides taps that supply alternating current for use with electrodes ranging from 5/64 to 3/16 inch in diameter. A continuous-current range from 20 to 200 amperes is provided for welding, hard-facing, brazing, heating, and soldering. 134

Conomatic Eight-Spindle Automatic

The Cone Automatic Machine Co., Inc., Windsor, Vt., has announced the addition of a 1 5/8-inch Model VE to its line of eight-spindle Conomatics. This machine and two other Conomatics will be demonstrated at the European Machine Tool Show being held this month in Milan, Italy.

The eight-spindle machines are particularly suited to work that ordinarily would require second-processing operations since they eliminate the need for a second handling of the work. They are also especially adapted for machining components requiring the drilling of unusually deep holes, particularly if one or more other operations, such as counterboring, reaming, threading, or tapping, must be performed on the end of the work.

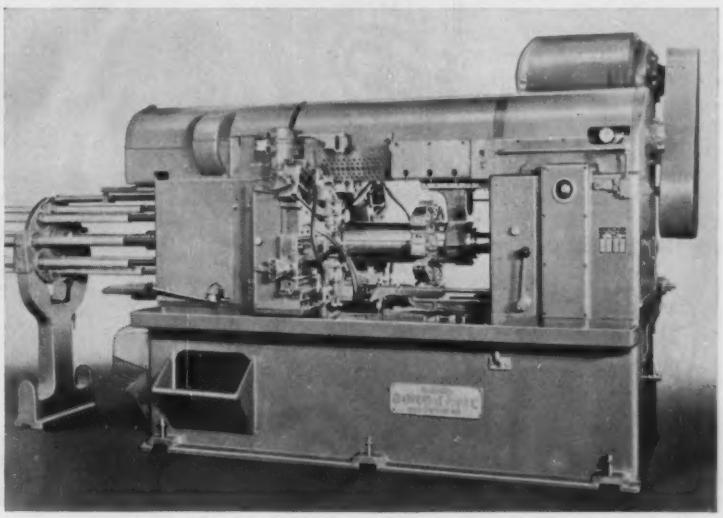
Provision for stock-feeding in the fifth position as well as in the first position, permits many jobs to be handled efficiently by duplicate tooling set-ups on these machines.

The Model VE has been designed to permit handling work requiring a motor drive ranging from 30 to 60 H.P. Large diameter power-transmission shafts and large tooling areas have been provided to accommodate the heavier and larger types of tool and attachment heads required for the use of carbide-tipped tools. Forty-two work-spindle speeds ranging from 125 to 2470 R.P.M. are available. Duplicate controls are provided on both sides of the machine 135

"Cylindex" Surface Grinder Attachment

A surface grinder attachment designed to perform precision cylindrical and indexing grinding operations is a recent product of Binghamton Die & Machine, Inc., Binghamton, N. Y. This attachment, called "Cylindex," will fit all makes of surface grinders. Weighing only 23 pounds, it is easily handled, and can normally be set up in five to ten minutes. The attachment is driven by a 1/20-H.P. totally enclosed motor. A sine bar is provided for precision settings and screw adjustments facilitate taper-grinding up to an angle of approximately plus or minus 20 degrees.

The attachment is said to main-



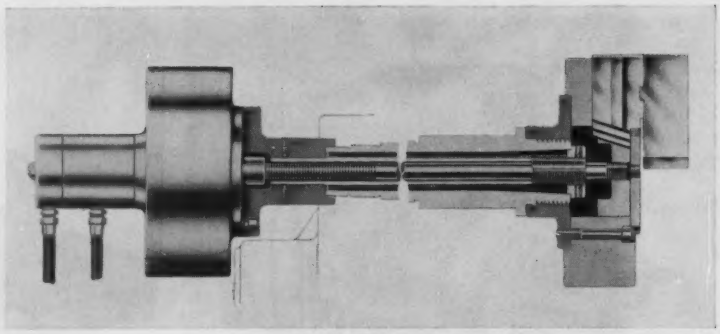
Eight-spindle Conomatic announced by the Cone Automatic Machine Co.

tain an accuracy of 0.0002 inch on work held on dead centers. The tailstock release can be operated from the front of the surface grinder. The length between centers is 7 1/4 inches and the swing, 6 inches. Stock up to 2 inches in diameter can be ground through the use of a four-jaw chuck. . . 136

Skinner "Junior" Power Chuck Unit

The Skinner Chuck Co., New Britain, Conn., is introducing a power chuck unit, called "Junior," that is designed to enable small lathes to operate with the economy and production speed of larger machines. This unit can be adapted to almost any small lathe having a 1- to 1 3/8-inch hole through the spindle. The light weight and precise balancing of the unit serve to minimize the loads imposed on the spindle bearing and the brake. It is claimed that repetitive work can be chucked internally or externally with extreme accuracy when this new unit is employed.

This 8-inch self-centering chuck has a gripping capacity of from 1/4 inch to 6 inches. It has a jaw travel of 1/4 inch, this feature being particularly useful in second-operation work in which rough or finished holding diameters may vary beyond the gripping range of an ordinary collet.

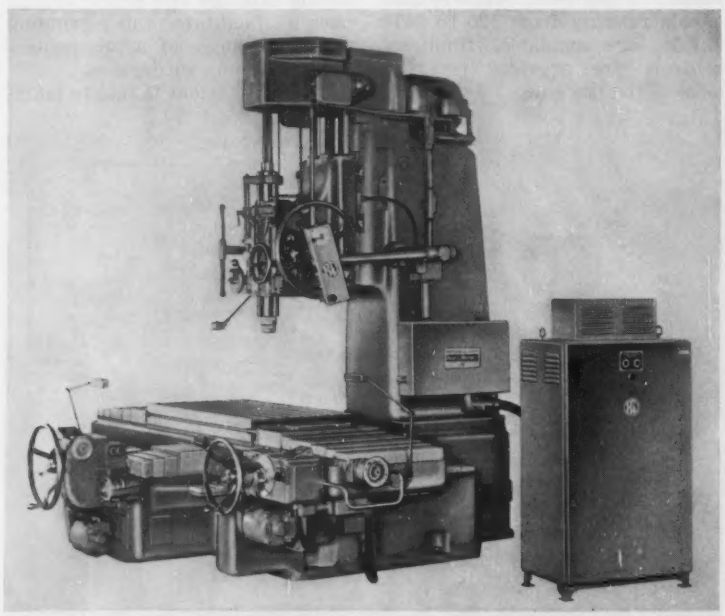


"Junior" power chuck unit brought out by the Skinner Chuck Co.

The complete power chuck unit includes an 8-inch three-jaw, wedge type, self-centering air chuck; a 6-inch high-speed, rotating aluminum air cylinder; an aluminum cylinder adapter plate; a cylinder mounting tube; a tube lock-nut; and a draw-bar. . . . 137

Pratt & Whitney Jig Borer Added to "Electrolimit" Line

A No. 3E jig borer has just been added by the Pratt & Whitney Division Niles-Bement-Pond Co., West Hartford, Conn., to the "Electrolimit" series. Ample working space is provided on this 13-ton machine by the 28- by 56-inch table which has a travel of 48 inches longitudinally and 28 inches transversely. Maximum height between the table and the end of the spindle is 30 inches. Columns 6, 10, or 14 inches higher than standard can be furnished to increase the work capacity.



Jig borer recently added to "Electrolimit" line by Pratt & Whitney Division Niles-Bement-Pond Co.

Milling feeds are electronically controlled and are infinitely variable from 1 to 15 inches per minute. Rapid power travel of 60 inches per minute is also provided. There are eight selective spindle feeds ranging from 0.0005 to 0.015 inch per spindle revolution, both up or down and twelve spindle speeds ranging from 30 to 1500 R.P.M. are provided through a gear-box and four-speed motor.

Two separate "Electrolimit" measuring units are employed, one for longitudinal and the other for transverse movements. Each unit obtains basic 1-inch spacings electromagnetically from a solid notched master bar and registers a zero reading on an indicating meter without making physical contact. Fractional inches are obtained by moving an electromagnetic head by means of a precision micrometer graduated for easy reading to 0.0001 inch. A 1/32-inch movement of the 4 1/2-inch diameter micrometer thimble represents a setting change of 0.0001 inch, and allows smaller settings to be interpolated.

The precision preloaded quill "roll-feeds" on 360 precision balls preloaded between the hardened quill and liner with a total bearing pressure of 8000 pounds. Vertical operation of the head assembly is controlled by push-buttons. An automatic interlocking mechanism clamps the head positively in position on the column after motion ceases, and releases it before the feeding motion starts. 138

For more information on these products, use Inquiry Card, page 243

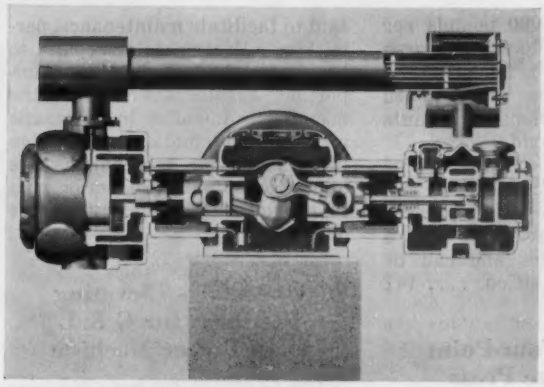


Fig. 1. Air compressor introduced by Ingersoll-Rand Co.

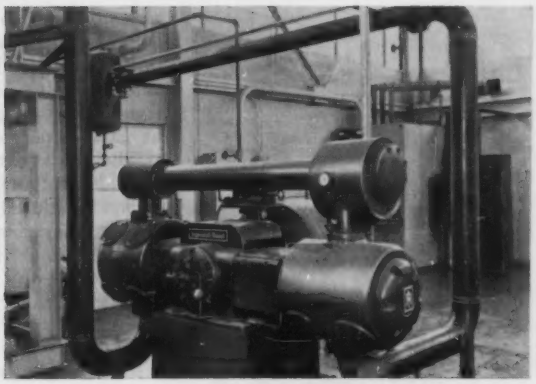


Fig. 2. Cross-sectional view of "PHE" compressor

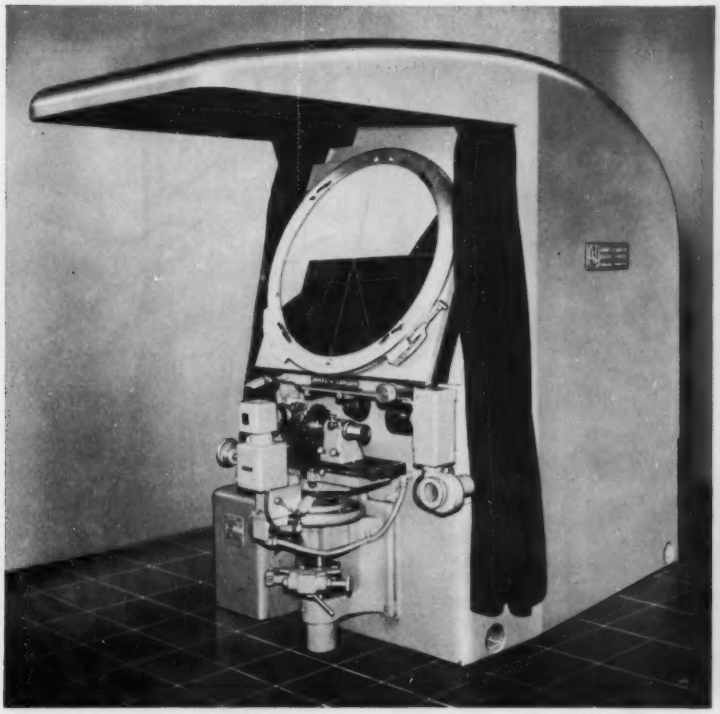
Ingersoll-Rand Air Compressor

A packaged air compressor in the 75- to 100-H.P. range was recently introduced by the Ingersoll-Rand Co., New York City. This new machine, known as the "PHE," is of opposed-cylinder, balanced design driven by a direct-connected induction motor. The compressor is a ready-to-run, heavy-duty unit, arranged in single or multiple stages. The basic design is a two-stage unit for a pressure from 80 to 125 pounds per square inch, but other cylinder arrangements are available for higher pressures or for pumping vacuums.

The compressor is suitable for a wide range of applications in shops, foundries, and large construction operations. The floating aluminum bearings of the crankshaft and piston-pins rotate slowly, thus taking the major thrust of each succeeding stroke on a different portion of the shell. All three main bearings are interchangeable. The piston and rod assemblies are shown in Fig. 2. Moving in opposite directions, on a 180-degree crank, these members balance out all primary and secondary inertia forces without the use of counterweights. . . . 139

Jones & Lamson Optical Comparator

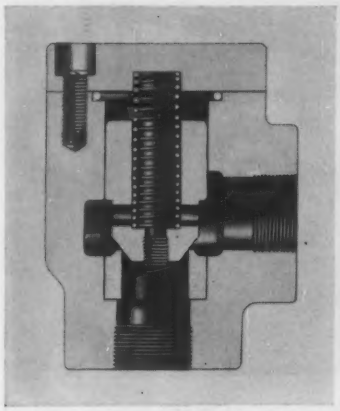
A standard Model FC-30 optical comparator just announced by the Jones & Lamson Machine Co., Springfield, Vt., allows the operator to easily stage cumbersome parts on a low-level worktable and to work within inches of the eye-level viewing screen. Electronically controlled, variable-speed power elevation provides quick, precise measurements to 0.0001 inch with fingertip control. Carbide-tipped micrometers graduated for direct reading in either direction are combined with the micrometer "zeroing" anvil. All measuring dials are illuminated.



Optical comparator introduced by the Jones & Lamson Machine Co.

For the first time, 5- and 8-inch work capacities are combined on one machine with easy changeover. A precision Jones & Lamson projection lens 6 inches in diameter is applicable to this machine. The hood allows permanent photographic records to be taken directly from the viewing screen, even when the light is poor.

Angles can be measured to 1 minute and a table rotation up to 15 degrees right or left is provided. Other features include a high-intensity projection lamp house adjustable for work clearance; a co-linear reflection attachment for brilliant surface illumination; and high-precision lenses of from 5 to 100 magnifications (up to 250 magnifications on special applications). 140



Rivett hydraulic check-valve for high pressures

Hydraulic Check-Valves for High Pressures

A new line of hydraulic check-valves has been introduced by Rivett Lathe & Grinder, Inc., Boston, Mass. The valves have been designed to allow a free flow of liquid in one direction and prevent flow in the opposite direction at pressures up to 3000 pounds per square inch. They have large area passages—the 1 1/2-inch valve, for example, being proportioned to handle 104.2 gallons per minute at 15 feet per second.

The valves can be had with pipe threads or flange connections and in spring-closed or pilot-operated types. They are available in 1/4 to 1 1/2-inch sizes and can be mounted in any position. 141

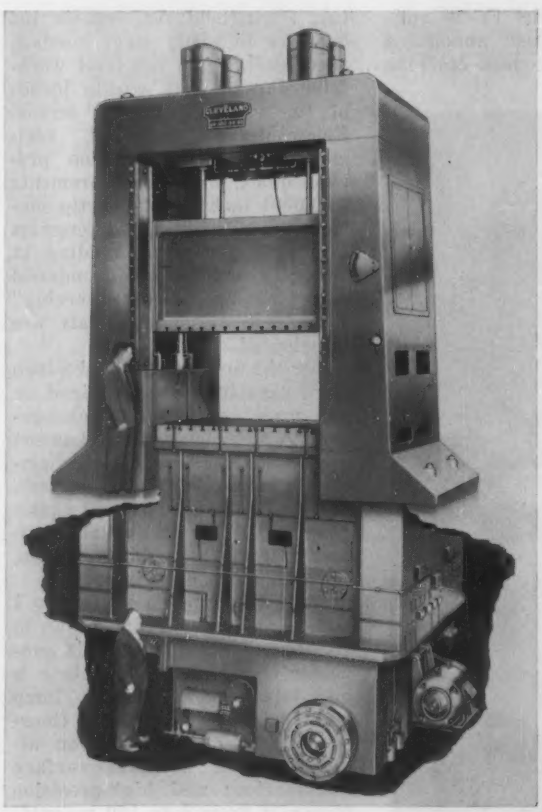
Cleveland Four-Point Underdrive Press

A four-point underdrive press with a capacity of 450 tons, a 20-inch stroke, and 60- by 80-inch slide and bed area, is announced by the Cleveland Punch & Shear Works Co., Cleveland, Ohio. This is a double-geared, twin-drive press with an air-counterbalanced slide. An air brake on the flywheel brings the machine to a quick stop when the power is shut off. Equipment includes a dynamic clutch and pneumatic cushions in the bed.

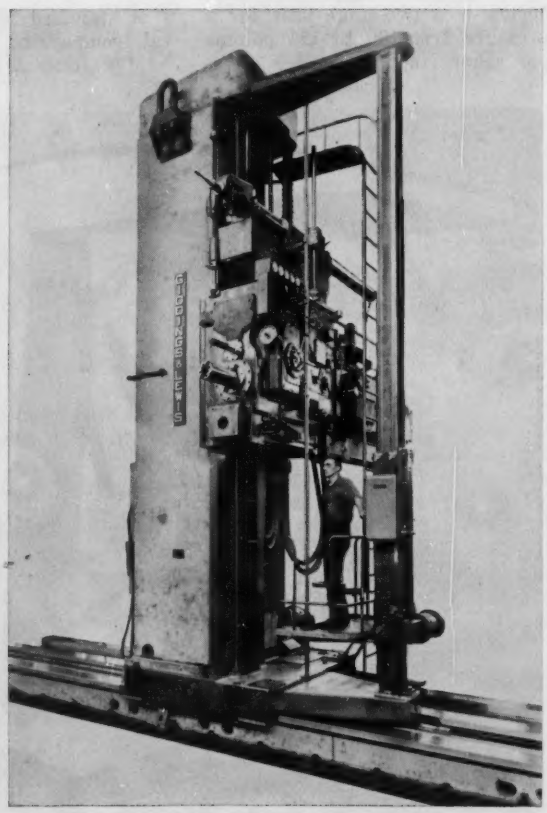
The underdrive construction is said to facilitate maintenance, permitting adjustments or repairs to be made at floor level—an important consideration when the machine is installed in automatic or semi-automatic production lines. All drive mechanisms are located outside the production area to provide for cleaner and safer operation. 142

Operator's Elevating Platform for G & L Fuar Tracer Machine

The Giddings & Lewis Machine Tool Co., Fond du Lac, Wis., has designed an operator's elevating platform for its 50 Series Fuar tracer machine. This unique "elevator" operates separately from the machine headstock and permits the operator to change his position to any height on the huge column without disturbing the spindle or stylus. He can also return quickly to the floor level for tools and other equipment, thus eliminating fatigue that results from climbing up and down the column ladder. 143

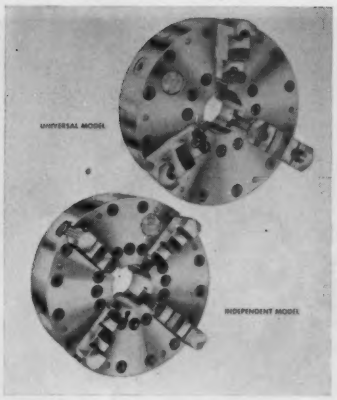


Four-point underdrive press has been brought out by the Cleveland Punch & Shear Works Co.



Giddings & Lewis Fuar tracer machine equipped with operator's elevating platform

For more information on these products, use Inquiry Card, page 243



Segmental-plate chucks made by the Whiton Machine Co.

Whiton Segmental-Plate Chucks

In a line of segmental-plate machine-tool chucks now available from the Whiton Machine Co., New London, Conn., the jaw slots are formed in separate, segmented plates which are subsequently mounted on the chuck body. These plates are hardened and finish-ground before being assembled, providing jaw slots that are said to be extremely accurate.

The segmental plates may be mounted on a body of heat-treated steel, of Ductile iron, or of aluminum alloy for use in high-speed turning operations. These chucks are offered in both independent and geared scroll models. A feature of the independent model is its full-circle thrust bearing which is locked into position within the chuck body by the segmental plates. On the scroll type chuck, the scroll bearing surface and spindle mounting section are hardened and ground. 144

Eisler Abrasive Cutter

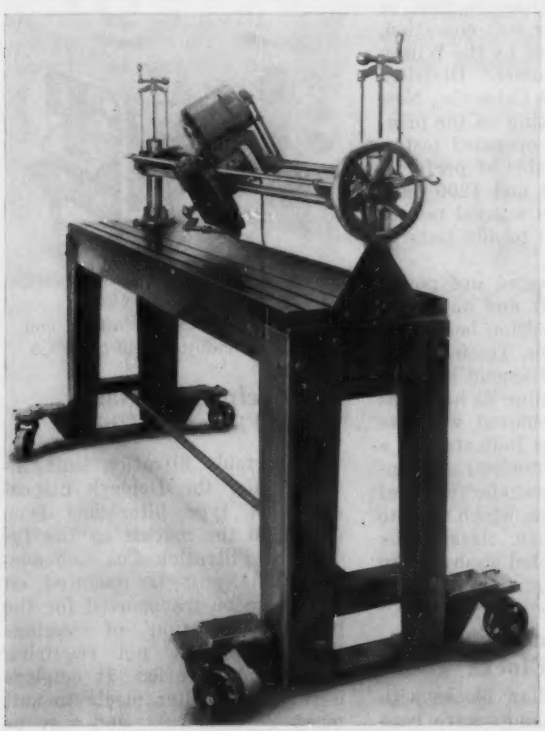
An abrasive cutter of the wet type for cutting and slicing tungsten, molybdenum, and other non-ferrous metals, as well as refractory materials and glass, has been placed on the market by the Eisler Engineering Co., Inc., Newark, N. J. The machine, designated No. 11-TMM, is also suitable for making longitudinal cuts on bars, tubes, and sheets.

The work-head carries a cutting wheel 12 inches in diameter by 1/16 inch thick, which is driven by a 1/4-H.P. motor running at a speed of 1720 R.P.M. The work-head slides on two 1 1/4-inch diameter bars and can be traversed over a distance of 42 inches. The traverse movement is obtained manually by means of a handwheel and feed-screw which engages a half-nut on the work-head. For quick return, the half-nut is disengaged, and the work-head moved back by hand. The work-head can be tilted and locked at any angle between the vertical and horizontal positions. A protractor serves to indicate the angle. 145

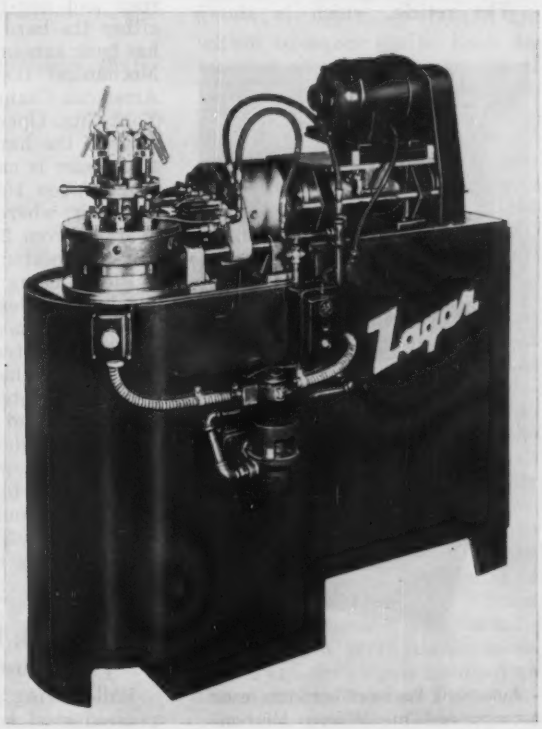
Zagar Special-Purpose Drilling Machines

One of a series of drilling machines built for special purposes by Zagar Tool, Inc., Cleveland, Ohio, is shown in the illustration. Standard Zagar hydraulic feed units and gearless drill heads are used. The feed unit includes a base which serves as a table for the manually operated six-station indexing fixture. While three stations are at the drilling positions, the remaining three stations are left open for loading and unloading the work.

The feed units and drill heads are removable and can be adapted for other jobs by changing tools. The feed units have a long stroke and operate with a maximum of 7 1/2 H.P. 146

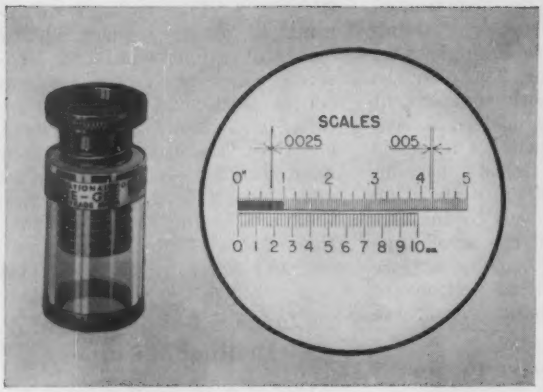


Abrasive cutter marketed by Eisler Engineering Co., Inc.

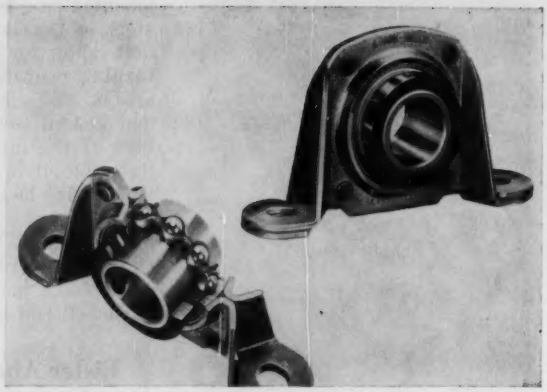


Special drilling machine built by Zagar Tool, Inc.

For more information on these products, use Inquiry Card, page 243



Pocket comparator introduced by the National Tool Co., magnified reticle being shown at right



Ball-bearing pillow block which has been brought out by the Link-Belt Co.

"Pee Gee" Pocket Comparator

A precision low-cost optical instrument, the "Pee Gee" pocket comparator, is being distributed by the National Tool Co., Cleveland, Ohio. This comparator can be used to measure extremely small parts or minute dimensions on large parts through the use of a powerful magnifying lens of approximately 6 power and tiny transparent patterns, or reticles. The reticles are actually extreme reduction of large layouts.

The reticle, which is shown greatly enlarged at the right of the instrument, is used to measure dimensions from 0.0025 to 0.5 inch in steps of 0.0025 inch and 0 to 0.10 millimeter in steps of 0.2 millimeter. Other reticles are available for measuring radii, angles, threads per inch, and diameters of circles. 147



Automatic Rockwell hardness tester announced by Wilson Mechanical Instrument Division, American Chain & Cable Co.

Automatic Rockwell Hardness Tester

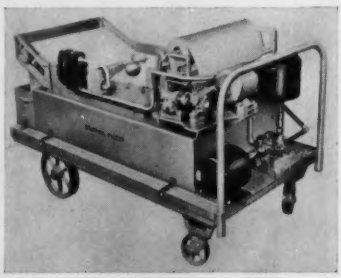
A fully automatic Rockwell hardness tester for quality control testing of the hardness of ferrous and non-ferrous metals, in either the hard or soft condition, has been announced by the Wilson Mechanical Instrument Division, American Chain & Cable Co., New York City. Operating on the principle of the hand-operated tester, this tester is capable of performing between 1000 and 1200 tests per hour, whereas manual testers average from 200 to 400 tests in the same period.

Pieces being tested are power fed into the tester and automatically placed in position beneath a diamond penetrator. Testing loads which force the diamond into the material to determine its hardness are applied and removed, with the resulting hardness indicated on a dial. Minute photoelectric transistors serve to transfer the dial reading to impulses, which actuate relays that, in turn, classify the material being tested according to its hardness. 148

Link-Belt Ball-Bearing Pillow Blocks

Ball-bearing pillow blocks with pressed steel housings have been announced by the Link-Belt Co., Chicago, Ill. These pillow blocks can be employed economically for light-duty applications where speeds are relatively low. The precision deep-groove single-row ball bearing is self-aligning.

The pillow blocks are available for shafts from 5/8 inch to 1 1/4 inches in diameter. They are easily installed by slipping the inner ring on a shaft and locking it in position. Slotted bolt holes permit lateral adjustment. A synthetic rubber lip type seal, integral with the bearing, efficiently retains the lubricant and excludes dirt. .. 149



Delpark portable filtration unit made by Industrial Filtration Co.

Delpark Portable Filtration Unit

A portable filtration unit incorporating the Delpark disposable belt type filter has been placed on the market by the Industrial Filtration Co., Lebanon, Ind. This unit is mounted on casters to be transported for the periodic filtration of various liquids and oils not requiring continuous filtration. It employs a variety of filter media to suit many requirements, and may be used on coolants, and quenching, cutting and hydraulic oils. ... 150

For more information on these products, use Inquiry Card, page 243



Fig. 1. Sheffield air gage for checking six critical dimensions of engine pistons



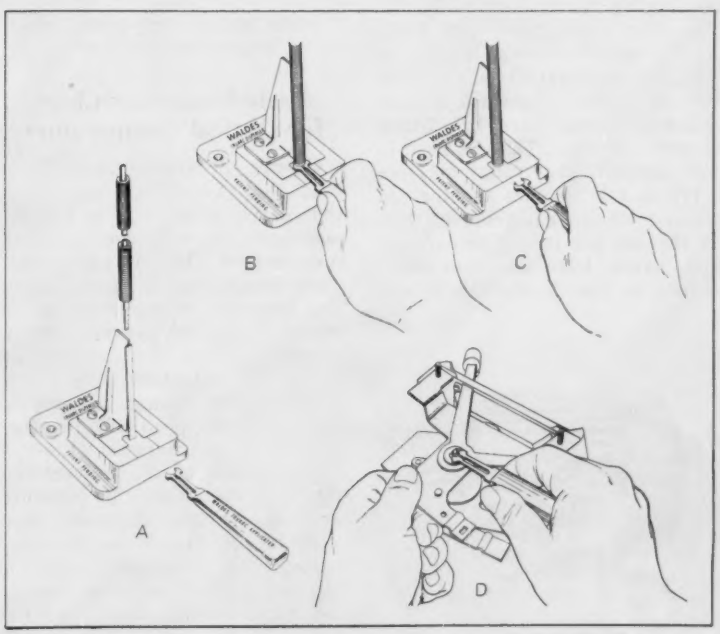
Fig. 2. Sheffield electrical multiple gaging instrument for checking body of shell

Gages for Inspecting Engine Pistons and Shell Bodies

A bench type air gage, Fig. 1, for automatically inspecting six critical dimensions on an engine piston is a product of the Sheffield Corporation, Dayton, Ohio. The unit consists of a chromium-plated air ring that incorporates two sets of matched "Plunjet" gaging cartridges for checking the skirt diameter at top and bottom, including 0.001 inch of taper; two air spindles, each having six air jets for determining the average diameter of each pin bore; and two "air snaps"for measuring the height between the center line of the pin bores and the top of the dome.

Pin-bore diameters are classified in five sizes in increments of 0.0001 inch, and skirt diameters are segregated into 16 classifications of 0.0002 inch each. Positions of floats in the Precisionaire column indicate whether or not the dimensions are within the specified tolerance.

An electrical multiple gaging instrument, Fig. 2, which inspects seven critical dimensions simultaneously on a shell body, with the operator having only to load and unload the part, is another development of the Sheffield Corporation. In using this instrument, referred to as a "Multichek," the operator places the part on the loading platform and slides it forward into the gaging position. The master light on the diagram panel then reveals whether or not all dimensions being checked are within tolerance limits. Each dimension also has its own signal light. If one or more dimensions are out of tolerance, the master light turns red and the signal lights indicate the faulty dimensions by turning red or green to indicate under or over size. . . 151



Illustrating use of Truarc retaining ring dispenser made by Waldes Kohinoor, Inc

Truarc Retaining Ring Dispenser

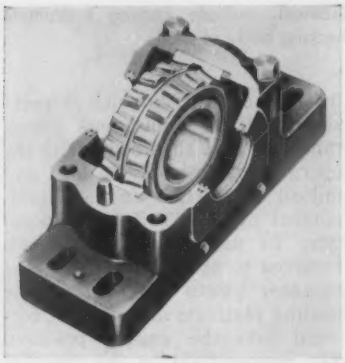
A dispenser for Truarc crescent and E-shaped retaining rings has been introduced by Waldes Kohinoor, Inc., Long Island City, N. Y. Rings may be extracted from the dispenser and installed in a product at a rate of speed limited only by the efficiency of the operator. An applicator is simply placed in contact with the surface of the unit base and pushed forward in a shim plate opening until it grips the bottom ring in a stack, as indicated in view B. It is then withdrawn and the ring is mounted on the work, as shown at D, to complete the operation. This type of dispenser is also available with triple stack-rods. 152

For more information on these products, use Inquiry Card, page 243

Press Fit "Mill Bearings"

The line of "Mill Bearings" made by the Link-Belt Co., Chicago, Ill., has been expanded to include pillow blocks with heavy-duty, self-aligning roller bearings designed for a press fit on shafts. These bearings are particularly adaptable for use in steel mills and other heavy industries. Like the rest of the line, the new Series LPK7800F bearings have steel split housings. The rugged caps and bases are secured with four extra-heavy bolts and large dowels.

The press fit of these bearings on machined shafts provides positive concentric mounting, and lock-nuts and lock-washers assure positive location. The bearings are available in a bore size range of from 3.1496 to 7.4803 inches. . 153



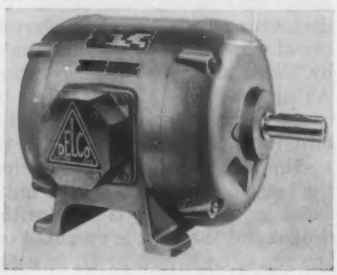
Press fit "Mill Bearings" announced by Link-Belt Co.

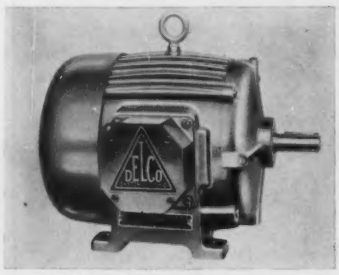
Delco Open Drip-Proof and Totally Enclosed Fan-Cooled Motors

The Delco Products Division of General Motors Corporation, Dayton, Ohio, has announced alternating-current squirrel cage, induction electric motors in frame sizes from 182 through 326. These motors are manufactured to meet the new NEMA standards on re-rated frame sizes.

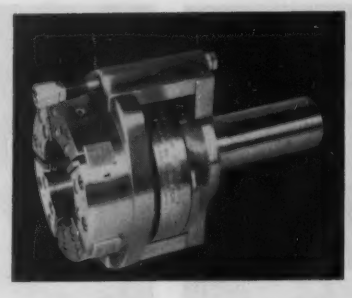
The open drip-proof motor of this line illustrated at the left, features cast-iron main and end frames, aluminum die-cast rotors, grease lubricated double-shielded ball bearings, "Delcote" cotton and varnish insulation, and a baffle cast as part of the end frame which protects the motor from dripping liquids.

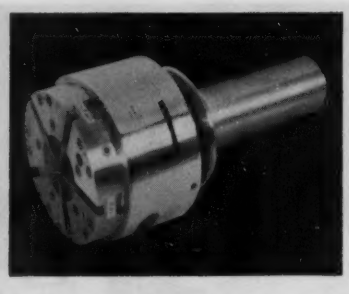
The totally enclosed fan-cooled motor, at right, is built with sturdy ribbed frame construction which allows the external fan to direct air over the frame. . . . 154





(Left) Delco open drip-proof motor; and (right) totally enclosed fan-cooled motor





(Left) Light-duty and (right) automatic insert chaser die-heads added to the line of the Eastern Machine Screw Corporation

Chaser Die-Heads

The Eastern Machine Screw Corporation, New Haven, Conn., is bringing out two new die-heads. The Size 11005 Style DM H&G insert chaser die-head, shown at left, is a light-duty type designed for use on No. 2 Brown & Sharpe automatics that have 1 1/2-inch capacity spindles. This die-head is for thread sizes ranging from 1 1/8 to 1 1/2 inches and for use where pitches are not coarser than 18 threads per inch. The carriers and chasers have the same cross-section as used in the No. 00 size die-heads but there are five chasers and carriers to a set. The Size 152 Style MM automatic H&G insert chaser die-head, at the right, has five chasers and carriers per set and covers a capacity range of 1/4 inch to 1 1/4 inches in diameter. 155



Scherr optical comparator with angle-measuring chart

Angle-Measuring Chart for Optical Comparators

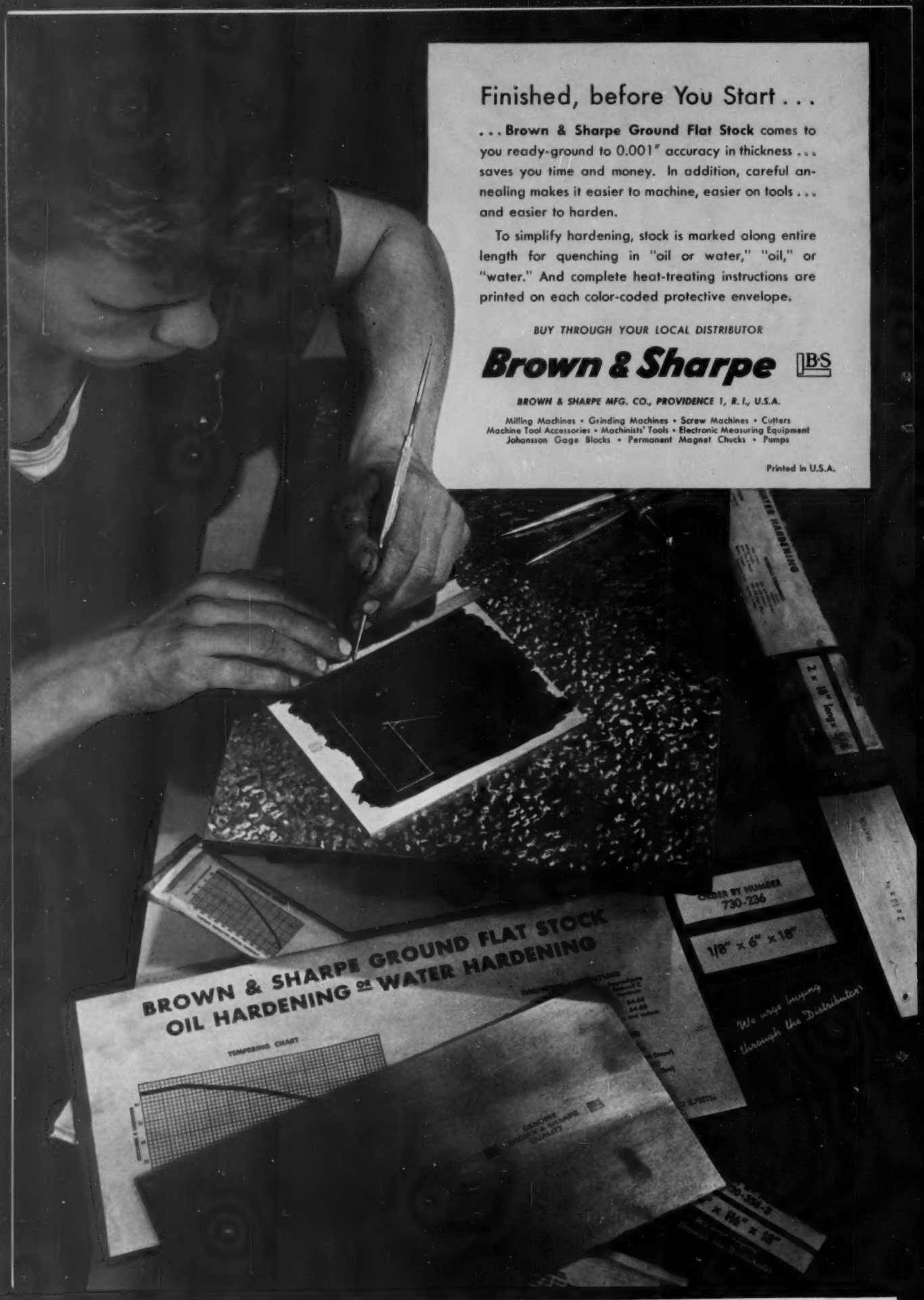
George Scherr Optical Tools Inc., New York City, announces the development of an angle-measuring chart for use on optical comparators. This protractor type chart is designed to permit rapid and accurate measurement of all angles up to 360 degrees with a vernier reading to 5 minutes of arc. It is adaptable to Wilder micro-projectors, and to all projectors not equipped with protractor screens or rotary tables.

The chart, of an unbreakable plastic, is not affected by moisture or temperature changes. Also available on plastic are a great variety of standard projector charts for checking screw threads and radii. Special charts and fixtures can be supplied. 156

(This section continued on page 235)

For more information on these products, use Inquiry Card, page 243


Hold Everything . . . At the Turn of a Lever!
Brown & Sharpe Permanent Magnet Chucks give you faster, dependable chucking for a wide variety of jobs. Their powerful magnetic grip engages or disengages at the turn of a lever. Strong *permanent* magnets make holding ability completely reliable . . . immune to plant power failures. And, freedom from electric wires permits using these chucks anywhere in the shop. Rectangular Models in 8 sizes from 2½"x5" to 12"x36"; Rotary Models in 5", 7" and 9" diameters. Write for catalog containing specifications on the complete line.
Brown & Sharpe



Finished, before You Start . . .

. . . **Brown & Sharpe Ground Flat Stock** comes to you ready-ground to 0.001" accuracy in thickness . . . saves you time and money. In addition, careful annealing makes it easier to machine, easier on tools . . . and easier to harden.

To simplify hardening, stock is marked along entire length for quenching in "oil or water," "oil," or "water." And complete heat-treating instructions are printed on each color-coded protective envelope.

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BROWN & SHARPE MFG. CO., PROVIDENCE 1, R. I., U.S.A.

Milling Machines • Grinding Machines • Screw Machines • Cutters
Machine Tool Accessories • Machinists' Tools • Electronic Measuring Equipment
Johansson Gage Blocks • Permanent Magnet Chucks • Pumps

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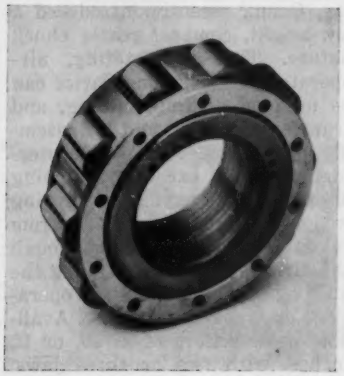


Chicago-Latrobe "Harduty" Drills and Reamers

"Harduty" drills with high-speed steel bodies and heavy-duty carbide-tipped points manufactured by Chicago-Latrobe Twist Drill Works, Chicago, Ill. These drills are designed to produce accurate holes in die steels having a hardness of 40 to 65 Rockwell C. They will produce holes in hardened steel with good surface finish and without annealing. The drills are available in sizes ranging, by increments of 1/32 inch, from 1/16 through 3/4 inch in diameter. "Harduty" reamers with carbide tips and high-speed steel bodies, taper shanks, and straight flutes are also available. These tools will ream accurate holes in steel having a hardness of 40 Rockwell C. They are made in diameters ranging from 1/4 to 3/4 inch. ...157

Radial Roller Bearing that Uses Gear as Outer Race

Cylindrical roller bearing, manufactured by Rollway Bearing Co., Inc., subsidiary of Lipe-Rollway Corporation, both of Syracuse, N. Y. The bearing shown in the illustration supports one end of a truck transmission shaft. Because the bearing runs directly in the bore of the main-shaft stem gear, no outer race is required. The stem gear is given the same hardness and finish as the outer race of a normal bearing. The space-saving resulting from the removal of the outer race allows the use of a larger roller assembly, which increases the load-carrying capacity. When space permits the use of an outer race, the bearing is applied in its self-contained form, consisting of an inner race, a bronze separator, and an outer race equipped with retaining rings. 158



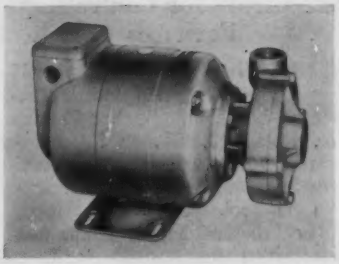
Armstrong Ground Tool Bits

Two lines of tool bits offered by the Armstrong Bros. Tool Co., Chicago, Ill., include ground bits of high-speed steel and cobalt high-speed steel. These bits are accurately ground on all four sides and have a 10-degree bevel on the ends. Both types are available in a full range of twelve sizes from 3/16 inch to 1 1/4 inches square, packaged for easy handling. .. 159



Motor-Driven Rumaco Centrifugal Pump

Direct-connected compact motor-driven "Rumaco" centrifugal pump, Model D-501, developed by the Ruthman Machinery Co., Cincinnati, Ohio. This circulating pump is adaptable to a wide range of applications, including air-conditioning installations. It will pump up to 40 gallons per minute under a 30-foot head. The unit, being bronze-fitted, will handle water and other liquids without danger of rust or corrosion. It is equipped with a self-adjusting seal, and is furnished with a 1/4-, 1/2-, or 3/4-H.P. motor. The pump can be installed either vertically or horizontally by using the standard integral NEMA motor base. 160



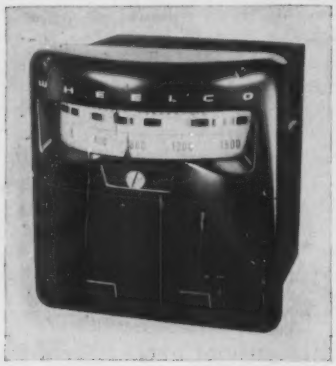
"Fleetwelder Special" Alternating-Current Welder

"Fleetwelder Special" alternating-current type welder built by the Lincoln Electric Co., Cleveland, Ohio. This heavy-duty machine is available in 300-, 400-, and 500-ampere sizes, NEMA rated, and is designed for production welding. The free circuit reactor control for the welding current is separate from the main transformer and can be adjusted continuously through a wide range of currents. The control is also sensitive to a wide range of welding conditions and highly responsive to changing arc conditions. The machines are adaptable to either sheet steel or heavy plate welding. An undercarriage for portability is optional equipment. 161



"Limitrol" for Controlling Furnaces

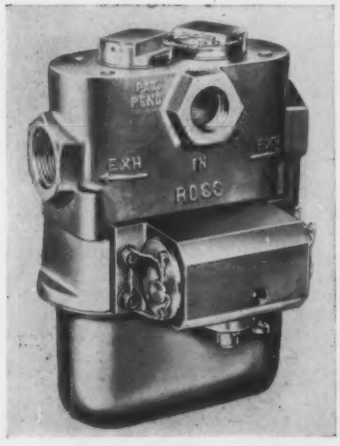
Wheelco "700" Series "Limitrol" brought out by Wheelco Instruments Division, Barber-Colman Co., Rockford, Ill., as insurance against human or instrument failures in the operation of furnaces. The control will automatically shut off the fuel supply at any predetermined temperature and, if desired, will sound an alarm. It also has a protection device which



will shut off the fuel input line in the case of thermocouple failure or broken connections. 162

Ross Air Control Valve

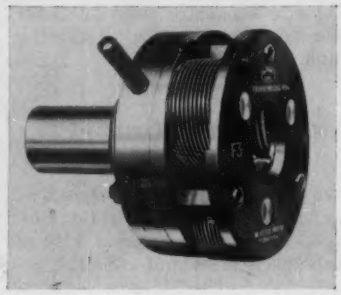
Air control valve called the "Lifeguard," recently introduced by the Ross Operating Valve Co., Detroit, Mich. This valve is designed to "sense" valve malfunctioning and shut itself off when any component does not operate normally. This feature is said to provide for exceptional safety in operating presses. Other features include high-speed operation up to 600



cycles per minute, simple installation, and precision poppet construction. 163

Self-Opening Thread-Rolling Head

National Acme "Fette" automatic self-opening thread-rolling head now being manufactured under



license and sold in the United States by the National Acme Co., Cleveland, Ohio. Rolled threads produced by this head are said to be stronger because of the cold-forging imparted to the metal by the rolling process. Made in non-revolving type in capacities from 1/16 to 1 inch, and in revolving type from 7/16 to 1 inch. 164



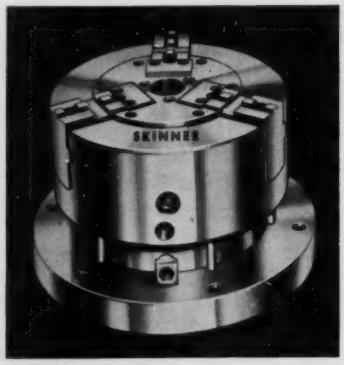
SPS Mobile Tool Stand

Mobile tool stand for assembly, inspection, and maintenance work, made by Standard Pressed Steel Co., Jenkintown, Pa. This heavy-gage steel stand is mounted on 2 1/2-inch swivel casters. It has a 14-inch high cabinet and two roller-suspended drawers. The top is a recessed tray. Dimensions are 18 by 24 by 35 inches. 165



Williams Lathe Tool Sets

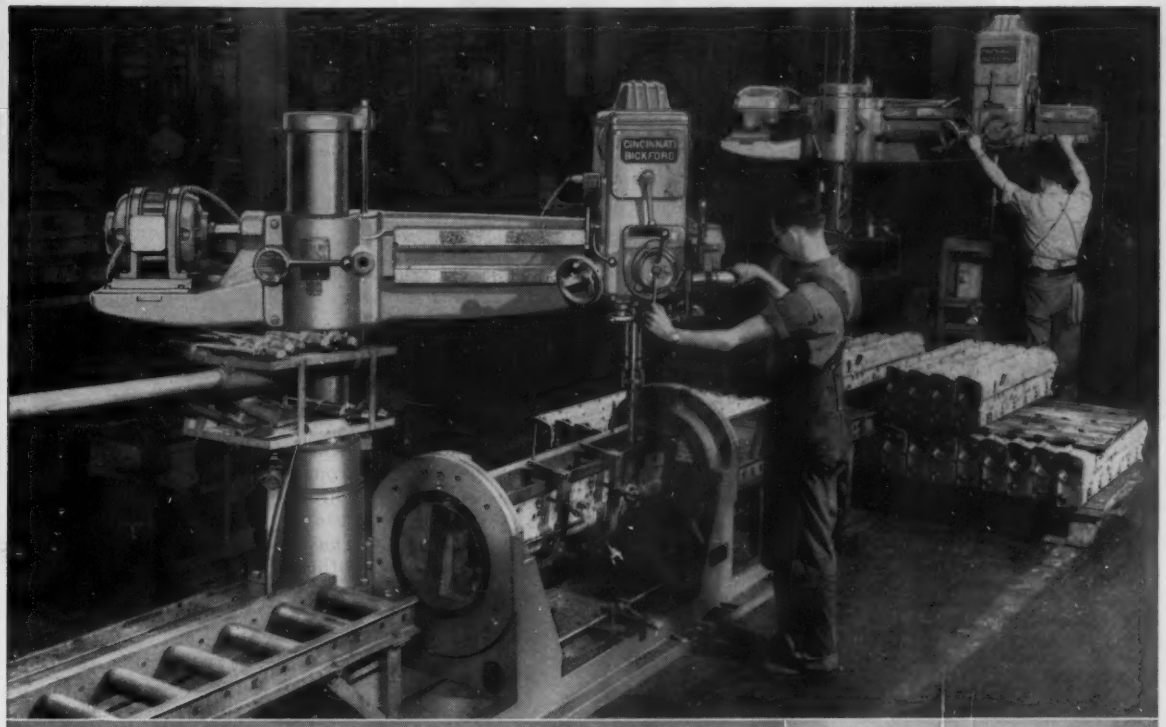
One of six lathe tool sets for turning, boring, knurling, threading, cutting-off, and side-cutting work brought out by J. H. Williams & Co., Buffalo, N. Y. High-speed cutters and wrenches are included in the steel case, which is fitted with clips for the holders. Each set includes three turning tool holders with straight, right- and left-hand shanks; one boring tool with sleeve bar; one threading tool with formed cutter; and one knurling tool with a pair of knurls. 166



Skinner Power Chuck Fixture

The Skinner Chuck Co., New Britain, Conn., recently introduced a low-height, compact power chuck fixture. This non-rotating, air-operated, work-holding device can be used on drilling, milling, and transfer machines, and for assembly operations. It is self-centering, and has excellent gripping power. The angle of the operating wedge prevents the chuck from releasing the work, even though the air line is broken, making the unit especially adapted for operations on transfer machines. Available in diameters of 8, 10, or 12 inches, with two or three jaws.

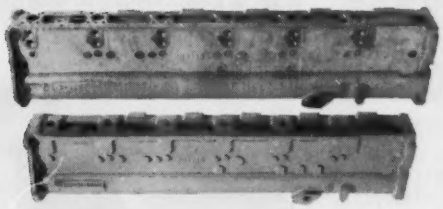
For more information on these products, use Inquiry Card, page 243



3 years of operation with NO MAJOR MAINTENANCE . . .



Photos courtesy Caterpillar Tractor Co., Peoria, Illinois.



Camshaft Housings for new Caterpillar DW21 Wheel-type Tractor illustrated in insert picture, showing casting before and after drilling operations.

The performance of Cincinnati Bickford Super Service Radial Drills at Caterpillar Tractor Co. has been outstanding, steady and trouble free.

On this job, including drilling, tapping and reaming, 116 holes are produced, 14 are reamed within .0005″ tolerance. Caterpillar Tractor Co. also states Cincinnati Bickford Super Service Radial Drills have contributed to the advancement of their product.

Write for Catalog R-21-C.

80 YEARS OF SERVICE

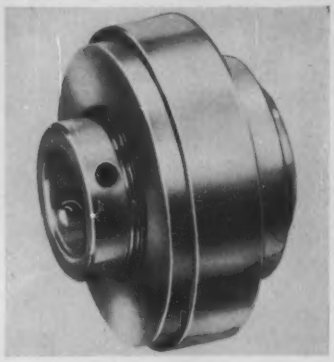
CINCINNATI BICKFORD

RADIAL AND UPRIGHT DRILLING MACHINES

THE CINCINNATI BICKFORD TOOL CO.

Cincinnati 9, Ohio, U.S.A.

Adjustable jaws can be furnished for irregularly shaped parts. The recommended maximum operating pressure is 100 pounds per square inch. 167



Miniature Clutches

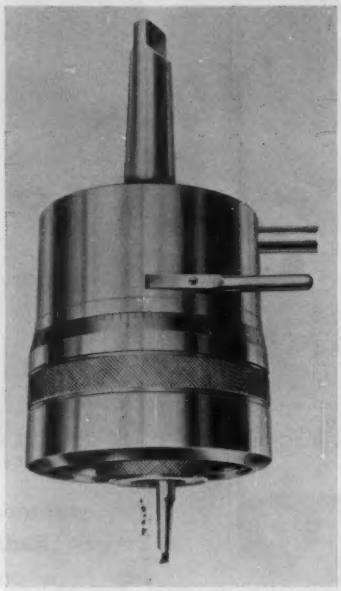
Miniature clutch of new series brought out by the Formsprag Co., Van Dyke, Mich., for overrunning, backstopping, and indexing applications. Four models are now available with bore sizes of 1/4, 3/8, and 1/2 inch. High torque capacity and minimum maintenance are features. ... 168

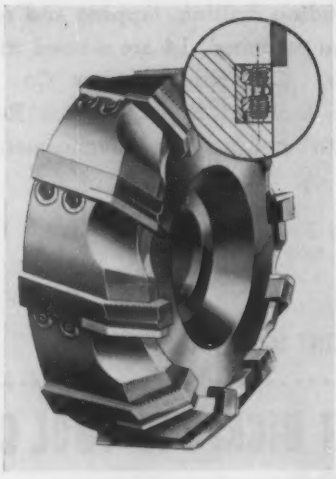
Face Mill Designed for Heavy Cuts

Cutter for rough-milling steel and cast iron when large amounts of stock must be removed in one operation, brought out by the Wesson Co., Detroit, Mich. The extra thick cutter body is an S. A. E. 6145 steel forging with thicknesses ranging from 3 1/4 to 3 3/4 inches. The 1 1/2-inch high, replaceable Wessonmetal carbide-tipped blades, capable of taking 7/8 inch deep cuts are positively locked with "Dual Wedg Locks," also made by the company. The wedges, actuated by a few turns of a lead-screw, are self-adjusting both axially and radially even if the blade is tapered, stepped, or out of square. 169

Internal and External Profiling Head

Profiling head, designated the Alina Model 30, brought out by the Bansbach Machine Co., Chicago, Ill. This tool is designed for turning any internal or external profile which will allow the tool bit to take a continuous cut. The head can be used in turning square, hexagonal, octagonal, and





other shaped profiles. Products that can be made with the head include profile collets; stamping, drawing, and forging dies; gages; and special tools. The head can also be used to machine cylindrical and taper forms. Interchangeable templates of the forms required in the finished products can be inserted in the head. The templates are approximately 1/4 inch thick and can be easily made in the user's shop. 170

Bench Type Micrometers

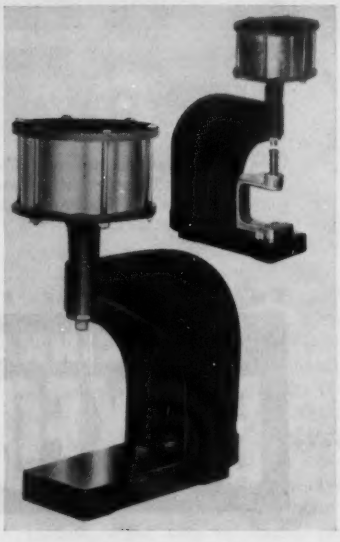
Bench micrometers announced by the George Scherr Co., Inc., New York City. These micrometers



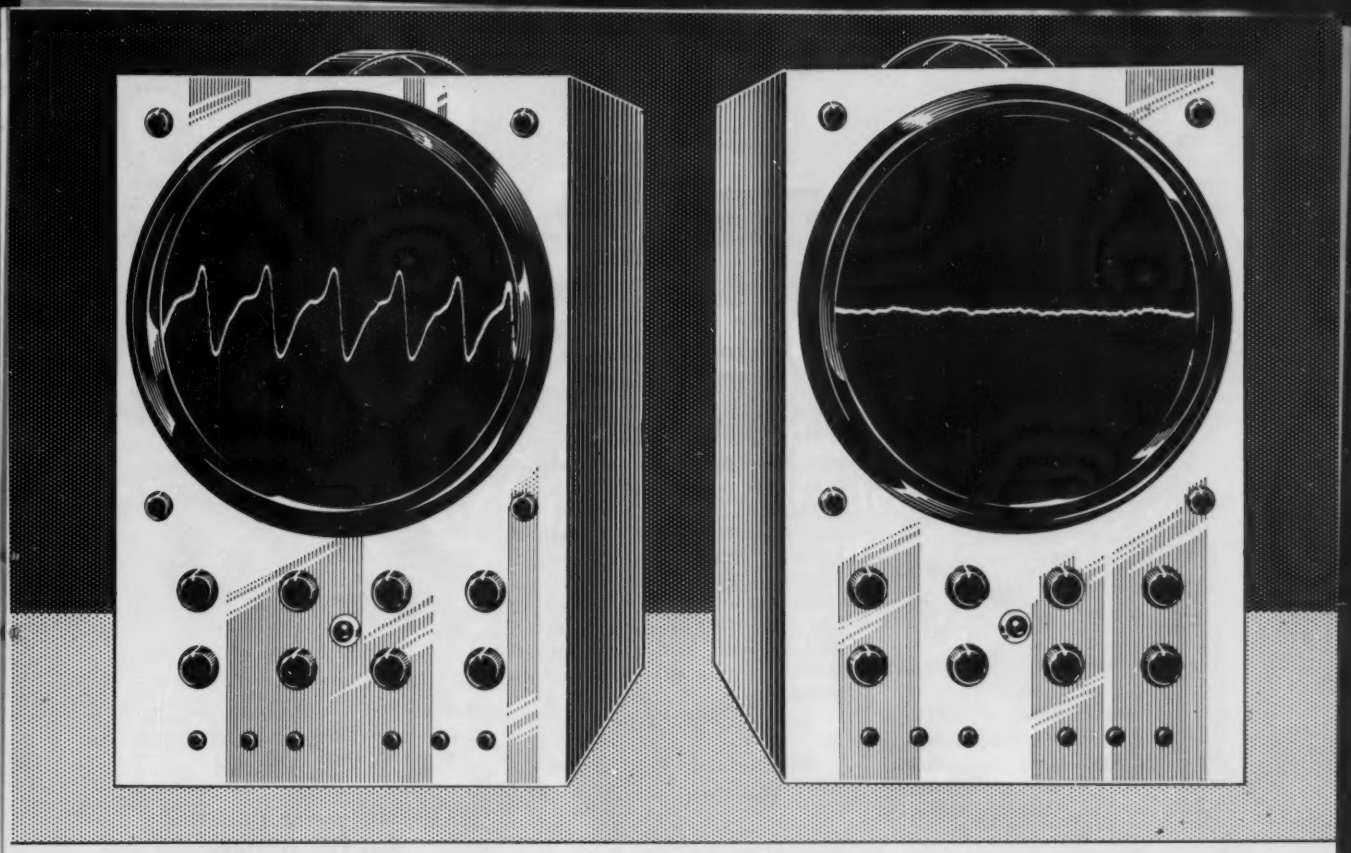
read to 0.0001 inch directly on a 1-inch diameter thimble. The micrometer heads are "Lustro-Chrome," dull finished for easy reading and prevention of rust. The Type No. 40G micrometer has a throat depth of 1.600 inches and tungsten carbide-tipped measuring surfaces. The range is 0 to 0.400 inch. The Type No. 40H micrometer has a non-rotating plunger type spindle with which eleven different interchangeable sets of anvils of various shapes can be used. The range is 0 to 1 inch, reading to 0.0001 inch; and the throat depth of the heavy base is 1.280 inches. 171

Paragon Air Presses for Production Work

Paragon air presses made in four sizes covering a range of 3/4 ton to 2 tons developed by Price Machine Products, Los Angeles, Calif. These presses have been designed to increase production on press-fit assembling, marking,



For more information on these products, use Inquiry Card, page 243



WHEN A STRAIGHT MINERAL OIL was used to lubricate the ways, an 0.0008″ jump at frequency of 2.74 cycles per second was noted.

WHEN SUNOCO WAY LUBRICANT was used on the ways, the jump was too small to measure, proof that this medium stops slip-stick motion.

TEST PROVES SUNOCO WAY LUBRICANT ENDS SLIP-STICK TABLE MOTION

How effectively Sunoco Way Lubricant stops slip-stick table motion is graphically illustrated by these oscillograms. The pattern on the left was made with a straight mineral oil as the lubricant; the other was made with Sunoco Way Lubricant on the ways. Both patterns are magnifications of changes in rate of table travel and were obtained under identical conditions.

You can stop slip-stick table motion, protect the ways, get better surface finishes, cut production losses with Sunoco Way Lubricant. Try it in your shop. For more information, call your nearest Sun office or write SUN OIL COMPANY, Philadelphia 3, Pa., Dept. M-9.

INDUSTRIAL PRODUCTS DEPARTMENT

SUN OIL COMPANY

SUNOCO®

PHILADELPHIA 3, PA. • SUN OIL COMPANY LTD., TORONTO & MONTREAL

Refiners of the famous Blue Sunoco Gasoline and Dynalube Motor Oils

forming, staking, light stamping, and similar successive operation jobs. Self-aligning sub-presses which are optional permit quick changing of set-ups. 172

Miniature Lightweight Universal Joint

Miniature, lightweight universal joint recently added to the line of Rzeppa constant-velocity joints

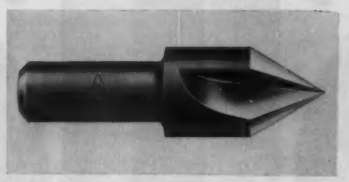


by the Joint Division of the Gear Grinding Machine Co., Detroit, Mich. Compactness, ruggedness, uniform flow of power, minimum weight, and long life are features claimed for this joint. The two views illustrate the adjustable-length feature of the shaft. .. 173

Skinner Quick-Exhaust Valve

Quick-exhaust valve designed to increase the operating speed of small air and hydraulic cylinders by more than doubling the return-stroke speed. Made by the Skinner Electric Valve Division, Skinner Chuck Co., New Britain, Conn. Most of the V5-3, three-way normally closed valves manufactured by this company can be equipped with this new quick-exhaust device. 174





Whitman & Barnes Center Reamers

High-speed center reamers, or countersinks, previously made only with 60- and 82-degree included angles, are now available with 90-, 100,- 110-, and 120-degree included angles from Whitman & Barnes, Plymouth, Mich. Sizes, increasing in steps of 1/8 inch, range from 1/4 to 3/4 inch in diameter. High-speed and carbon steel 60- and 82-degree countersinks are also available in convenient sets. 175

Retractable Caster Set for Power Tools

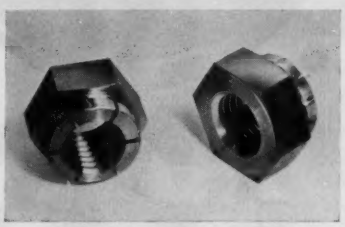
Low-cost retractable caster set introduced by the Delta Power Tool Division, Rockwell Mfg. Co., Pittsburgh, Pa. The casters fit all types



of Delta industrial metal and woodworking power tools normally mounted on steel stands, transforming them into portable tools. The casters can be lowered into the rolling position by means of a foot-lever. A light step on the pedal raises the wheels, allowing the power tool to rest solidly on the floor. 176

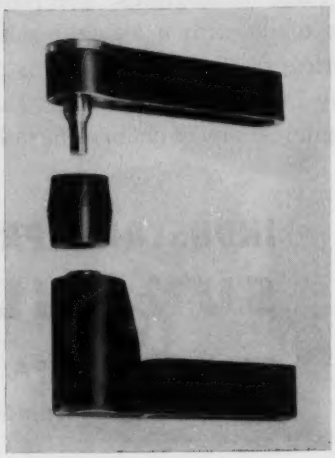
Flexloc Self-Locking Engine Nut

One-piece all-metal self-locking engine nut of Flexloc line made by the Standard Pressed Steel Co., Jenkintown, Pa. This alloy-steel cadmium-plated nut is designed for aircraft or automotive engine applications in which temperatures do not exceed 550 degrees F. It is distinguished from the standard Flexloc nut by an integral collar about 1/32 inch thick machined on the seat. The nut is available in sizes ranging from 0.190 to 0.500 inch in diameter with National Fine threads. Firm locking action is provided by the slotted top section, comprising six equal segments which are closed in to make the inside diameter of the locking collar smaller than the outside diameter of the companion bolt. 177



Retainers for Punches and Die Buttons

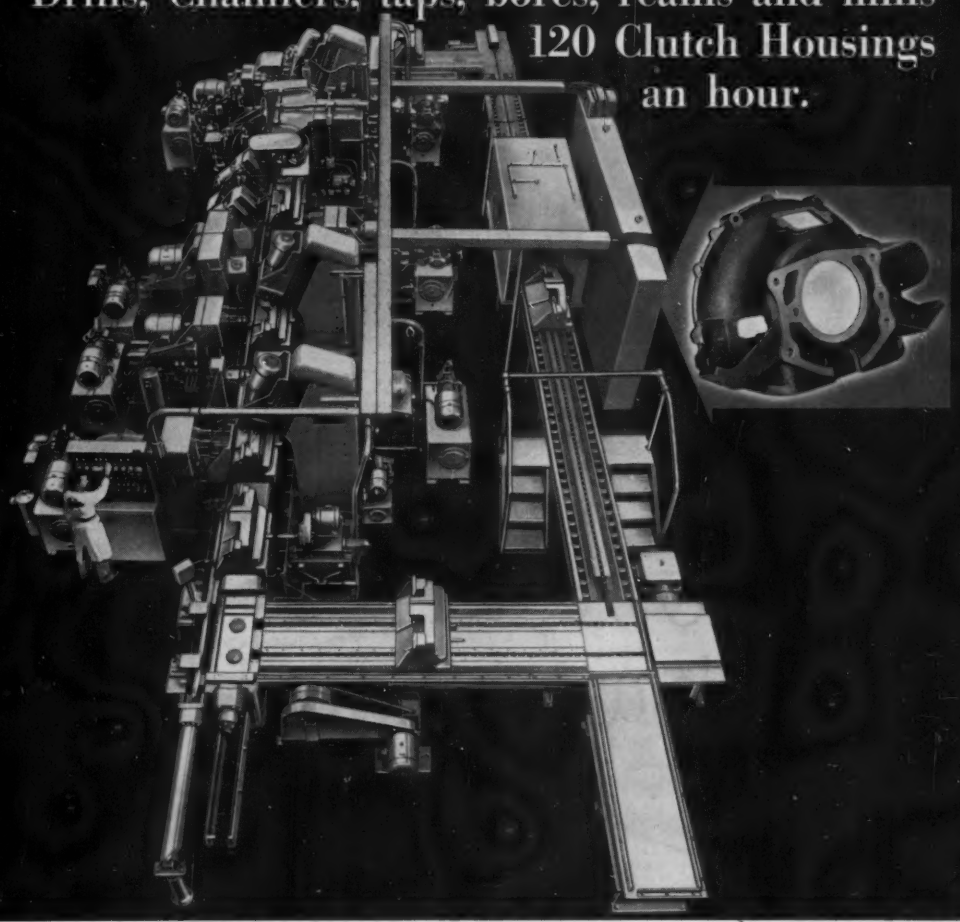
R-B punch and die retainers for short production runs on light-gage metals and where die cost is an important factor. They are adjusted to any desired position on T-slotted or drilled and tapped commercial die sets. Stripping is accomplished with R-B rubber strippers or rubber covered springs. Retainers are available for R-B punch shank diameters of 3/8, 5/8, 7/8, and 1 inch. Die buttons come in outside diameters of 5/8, 7/8, 1 1/4, and 1 3/4 inches. Recently added to the R-B line of Allied Products Corporation, Richard Brothers Punch Division, Detroit, Mich. 178



For more information on these products, use Inquiry Card, page 243

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Drills, Chamfers, taps, bores, reams and mills 120 Clutch Housings an hour.



Designed to perform identical operations on two different parts.
Through Selector Switches, change-over from one part to the other takes only seconds.
Twelve stations perform all 68 operations.
Fixtures automatically indexed from station to station, and go through Cleaning Station on return to Load Station, where Power Wrench clamps and unclamps.
Production is 120 parts per hour at 100% efficiency.

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TYPICAL STANDARD BUHR FEATURES INCLUDE:

- ★ Built-in chip conveyor.
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Why weigh down an operator with a heavier grinder? Put a new 7 pound air-powered CP Vertical Grinder in his hands and he'll remove the same amount of metal as he formerly did with a 10 pound tool!

Designed for driving cup wire brushes and grinding wheels, sanding discs, and cut-off wheels, the CP-3190 is tops for its handling ease and versatility. The features below explain why the CP-3190 takes the constant beating of heavy industrial usage with minimum maintenance:

- **Splined type floating rotor to prevent end-plate wear from wheel thrust.**
- **Continuous lubrication is afforded by large oil reservoir and built-in lubricator.**
- **Safety governor valve cuts off air supply in the event of possible governor failure.**

Available in speeds up to 8000 RPM and in capacities capable of handling 6″ cup wheels, and 7″ and 9″ disc sanding pads and cut-off wheels. For more information write *Chicago Pneumatic Tool Company, 8 East 44th Street, New York 17, N. Y.*

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NEW CATALOGUES

ALUMINUM—Reynolds Metals Co., Desk PR, 2500 S. Third St., Louisville 1, Ky. 220-page manual entitled "The Aluminum Data Book" (1954 edition), presenting detailed information on the properties and characteristics of aluminum. The book is thumb-indexed under these headings: High Purity, Physical, Chemical, Mechanical, Tolerances, Weights, and Availability. The new alloy designation system adopted by the Aluminum Association is covered. Can be obtained by engineers, designers, instructors, and executives on company letterhead request direct to the above address. To all others, the price is $1 per copy, postpaid.

CONTROL VALVES—Ross Operating Valve Co., 110 E. Golden Gate, Detroit 3, Mich. Catalogue 53, containing 118 pages of information on the 52 basic types of Ross valves—two pages being devoted to each type of valve, giving operation, standard and optional features, recommended service, installation data, and a parts list. This catalogue, on request to the company at the address given here, will be delivered personally by Ross sales engineers, who are located in thirty-five field service offices throughout the United States.

KNUCKLE JOINT PRESSES—E. W. Bliss Co., 1375 Raff Road, S. W., Canton, Ohio. Catalogue 12-B, 24 pages listing detailed specifications and dimensions for single, double, and non-geared knuckle joint presses. Also considered are such Bliss accessories as automatic feeds standard dovetails and overload relief beds. Can be obtained by writing on a company letterhead direct to the above address. . . . . .

DIAMOND GRINDING WHEELS—Action Diamond Tool Co., 4545 W. Grand Ave., Chicago 39, Ill. Catalogue 55, containing 44 pages descriptive of the company's Jetaline and RoBot Resin diamond grinding wheels, as well as a line of diamond dressers. Can be obtained on company letterhead request direct to the above address.

SHEAR BLADES—Wapakoneta Machine Co., Wapakoneta, Ohio. Catalogue describing the company's line of machine knives, shear blades, and cutters for the woodworking and steel industries. Can be obtained on a business letterhead request direct to the above address.

STAINLESS-STEEL STRIP CALCULATOR—Ulbrich Stainless Steels, Wallingford, Conn. Calculator working on slide-rule principle to aid in ordering stainless-steel cold-rolled strip and coiled stock. Can be obtained on company letterhead request direct to Ulbrich.

EPOXY RESINS—Bakelite Co., a Division of Union Carbide and Carbon Corporation, New York City. Technical Bulletins 1, 2, and 3 on Bakelite C-8 epoxy resins BR-18774, BR-18795, and BR-18794, respectively. These resins with the proper hardeners can be used in tooling, casting, laminating, embedding, and adhesive applications. Data are given on the physical properties of the resins and their hardeners. Included for each is a list of concerns equipped to render technical assistance and to supply specially formulated compounds for particular end uses. . . 1

HYDRAULIC TRACER ATTACHMENT—Axelson Mfg. Co. Division, Pressed Steel Car Co., Inc., Los Angeles, Calif. Bulletin 5401-20M, describing the Trace-O-Matic hydraulic tracer attachment that may be applied to Axelson heavy-duty lathes for duplicating turned parts from inexpensive flat templates. The bulletin includes information regarding machine set-ups and how to make templates. Case histories are also given. 2

CARBIDE BLANKS AND CUTTING TOOLS—Wesson Co., Ferndale, Mich. Catalogue 541, containing 121 pages on the company's complete line of carbide tools and accessories. Among these products are Wessonmetal carbide blanks, blades, and inserts; standard flat tools; milling cutters, blades, and arbors; and Multicut tool-holders. There is a 26-page engineering data section, including tool trouble-shooting suggestions. . . . 3

SETTLING AND FILTER SYSTEM—Industrial Filtration Co., Lebanon, Ind. Folder on a Delpark combination settling and filter system now available in stainless steel for the filtration of liquids which would be affected by other types of metals. Basic applications of this filter are in the food processing industry and in the paper-making industry. The system is designed for the filtration of particles larger than 0.004 inch. 4

NICKEL ALLOY STEELS—International Nickel Co., Inc., New York City. Bulletin A-68 entitled "The Tensile and Impact Properties of Quenched and Tempered Nickel Alloy Steels in Different Sizes." Over seventy charts show mechanical properties which may be regularly expected in the nickel alloy steels in various section sizes. The general characteristics of each type are briefly described. 5

LAY-OUT DRILLING MACHINE—Bryant Machinery & Engineering Co., Chicago, Ill. Catalogue 625 on the lay-out drilling machine built by the Cleereman Machine Tool Co. This machine was developed to handle dies, jigs, fixtures, molds, and other work not requiring tolerances closer than 0.001 inch per foot. The machine is also adaptable to small-lot jobbing production. 6

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INTERCHANGEABLE PUNCHES AND DIES—Richard Brothers Punch Division, Allied Products Corporation, Detroit, Mich. Booklet GG, consisting of 49 pages of descriptive information on the company's interchangeable punches, punch retainers, die buttons, die-button retainers, backing plates, retainer plates, die springs, and other products. A guide to proper punch selection is presented. . **7**

TAPER-BORING HEAD—John Kis Mfg. Co., Racine, Wis. Leaflet descriptive of a universal taper-boring head that may be adapted to a jig borer, a milling machine, or a horizontal boring-bar with a simple tapered or flanged type adapter, and used for such operations as taper-boring and taper-turning; back-facing; beveling; grooving; and straight boring and counterboring. **8**

GEAR SHAPERS—Michigan Tool Co., Detroit, Mich. Bulletin 1800-54, summarizing in 12 pages the company's gear shapers. The Shear-Speed process for cutting gears, splines cams, sprockets, and miscellaneous external shapes, one or several at a time, is explained. Some interesting applications are shown. . . **9**

AIRFOIL MILLING MACHINE—Pratt & Whitney Division Niles-Bement-Pond Co., West Hartford, Conn. Circular 575, descriptive of the Model 102 electronic airfoil milling machine developed and manufactured by the New England Machine & Tool Co., and sold by Pratt & Whitney, which also provides maintenance service. What the machine is and what it does are explained. **10**

STRAIGHT - SIDE, DOUBLE - CRANK PRESSES—Niagara Machine & Tool Works, Buffalo, N. Y. Bulletin 64-H, giving detailed information on the Niagara new line of straight-side, double-crank presses having capacities of from 50 to 300 tons. This line features fully enclosed construction. Specifications are tabulated for the nine models in this series. **11**

HYDRAULIC PRESSES—Denison Engineering Co., Columbus, Ohio. Catalogue 153, descriptive of the Denison Multipress. Illustrations show the presses performing such operations as blanking and forming, riveting, coining, drawing, crimping, and swaging—to demonstrate to manufacturers how costs can be cut through use of the Multipress. **12**

ARC-WELDING ELECTRODES—Metal & Thermit Corporation, New York City. 30-page catalogue, containing descriptive information along with application and procedure data on Murex mild-steel and low-alloy arc-welding electrodes. Formulas for estimating welding costs, hardness conversion tables, and welding symbols are included. **13**

ROLLER CHAINS AND SPROCKETS—Diamond Chain Co., Inc., Indianapolis, Ind. Catalogue 754, 64 pages covering the company's stock roller chains and sprockets. The line includes minimum bore sprockets for reboring, as well as finished-bore and taper-bushed sprockets ready to use. Chain selection and application data are given. **14**

STOCK PARTS FOR DIES—Toolcraft Industries Corporation, New York City. 28-page catalogue listing stock parts for dies, such as punches, die and guide bushings, quills, and lamination perforators. These parts are made in three types of steel, depending on requirements—high-carbon, high carbon-high chromium, and high-speed. **15**

ADJUSTABLE SPEED DRIVES—Dynamatic Division, Eaton Mfg. Co., Kenosha, Wis. Bulletin FAS, on fractional horsepower Ajusto-Spede drives. The booklet covers fundamentals of operation, capacity of available units, and mechanical construction features, and is illustrated by photographs, charts, and line drawings. **16**

TEMPERATURE-MONITORING SYSTEM—Thermo Electric Co., Inc., Saddle River Township, Rochelle Park Post Office, N. J. Bulletin 70, featuring the company's "SignaLarm" system, which is designed to signal the existence of a dangerous temperature at one or more of a large number of points in a plant. **17**

UNIVERSAL DRILLING MACHINE—Hartford Special Machinery Co., Hartford, Conn. Bulletin UM-100, covering the purpose and specifications of the company's new universal drilling machine, the capacity of which ranges from work 30 to 87 inches in diameter with bolt circle diameters of 8 to 65 inches. **18**

MOTOR PULLEYS—Reeves Pulley Co., Columbus, Ind. Bulletin V-545, comprising 27 pages on the Reeves Vari-Speed motor pulley, giving facts on construction, lubrication, and controls. Rating tables are presented as well as suggestions made for selection of the correct size motor pulley for a specific requirement. **19**

TITANIUM ALLOY—Mallory-Sharon Titanium Corporation, Niles, Ohio. Booklet giving physical properties of the MST 3A1-5Cr alloy, a titanium alloy containing 3 per cent aluminum, 5 per cent chromium, and less than 0.1 per cent carbon, which has been developed primarily for bar and forging applications. **20**

ROLLER BEARINGS—McGill Mfg. Co., Inc., Valparaiso, Ind. Bulletin SGR-54, describing Guiderol bearings, which are sealed full type roller bearings. Besides a dimensional table, there are tables on life factors and speed factors, shaft fits and tolerances, and housing fits and tolerances. **21**

HAND TORCHES FOR GAS CUTTING AND WELDING—Air Reduction Sales Co., New York City, Catalogue ADC 702B, 36 pages covering the Airco line of torches and tips for oxy-acetylene cutting and welding, the information being presented through carefully planned illustrations, charts, and descriptions. . . **22**

INJECTION MOLDING MACHINES FOR PLASTICS—Hydraulic Press Mfg. Co., Mount Gilead, Ohio. Bulletin 5406, on the company's complete line of injection molding machines for the plastics industry. Specifications are given for the different models, and examples of varied products are illustrated. **23**

ELECTRICAL COMPONENTS—Trumbull Components Department, General Electric Co., Plainville, Conn. Catalogue GEC-1025, containing 100 pages of comprehensive information on circuit breakers, disconnect switches, open knife switches, and component parts used in switchboards and panel boards. **24**

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SHOP AND TOOLING ACCESSORIES—Northwestern Tool & Engineering Co., Dayton, Ohio. Catalogue 22, containing pertinent information on 341 items made by the company, such as quarter-turn and knurled head screws, jig feet, washers, flanged nuts, hand knobs, fixture keys, T-nut and stud sets, step block sets, and punch press sets. **25**

BAR MACHINE—Cone Automatic Machine Co., Inc., Windsor, Vt. Folder on the Model VE Conomatic bar machine which has a maximum round stock collet capacity of 1 5/8 inches The components that make up the construction of the machine are identified by reference numbers. **26**

ELECTROPLATING—U. S. Galvanizing & Plating Equipment Corporation, Brooklyn, N. Y. 16-page booklet covering methods and equipment for electroplating. Typical installations are shown of plating barrels, tanks of all kinds, dryers, and other equipment. **27**

TUMBLING BARRELS—BMT Mfg. Corporation, Elmira Heights, N. Y. Booklet entitled "Modern Precision Tumbling," featuring BMT "SlideHoning," a new method of tumble finishing using a multiple-barrel unit. **28**

TURRET DRILLING MACHINE—Howe & Fant, Inc., East Norwalk, Conn. Bulletin 5403, descriptive of the company's turret drilling machine, which performs up to six different drilling and tapping operations at a single station, with one handling of the work. **29**

ELECTRODE FOR HARD-TO-WELD STEELS—Pacific Welding Alloys Mfg. Co., Los Angeles, Calif. Folder and sample of the newly developed Matrix electrode for building up hard-to-weld work preparatory to a final pass with hard-facing electrodes. **30**

TEMPERATURE MEASUREMENT—Tempil Corporation, New York City. Informative booklet entitled "How Temperatures are Measured." It concludes with a short description of the temperature-indicating lacquer, crayons, and pellets manufactured by the company. **31**

BUFF SELECTOR CHART—American Buff Co., Chicago, Ill. Wall chart, offering recommendations on proper surface speeds, spindle speeds, and buff diameters for practically any buffing job, based on current usage **32**

CHUCK JAW INSERTS—A & A Co., Inc., Plainfield, N. J. Folder descriptive of Perma jaws, which are equipped to take expendable inserts that can be tooled to fit any job. When the inserts are ground down, they can be replaced with new ones. **33**

HARDNESS TESTERS—Wilson Mechanical Instrument Division, American Chain & Cable Co., Inc., Bridgeport, Conn. Several catalogues in one loose-leaf folder comprising in all 49 pages of engineering data, uses, and design features of Rockwell hardness testers. . . **34**

WIRE THREAD INSERTS—Heli-Coil Corporation, Danbury, Conn. Bulletin 708, presenting data and installation instructions on Heli-Coil wire thread inserts and tools for National Coarse and Fine, Unified Coarse and Fine, spark-plug, and pipe threads. **35**

MOLDING PRESSES FOR REINFORCED PLASTICS—Hydraulic Press Mfg. Co., Mount Gilead, Ohio. Bulletin 5404, on the company's improved line of presses for molding reinforced plastics, in stock sizes of 100-, 150-, and 200-ton capacities. **36**

CARBIDES—Newcomer Products, Inc., Latrobe, Pa. Catalogue 109-54, consisting of 32 pages of information on Newcomer carbide blanks, inserts, and tools; boring and roller-turner tools; and toolholders. Included is a 9-page technical data section. **37**

ALUMINUM AND BRASS PRODUCTS—Bohn Aluminum and Brass Corporation, Detroit, Mich. Booklet entitled "Bohn Products and How They are Made," a 28 page photographic tour of the highlights in research, manufacturing methods, and assembly operations of the nine Bohn divisions. **38**

TOOL CONTROL UNIT—The Cross Company, Detroit, Mich. Folder describing in detail the company's recently introduced tool control unit for use on most types of metal-working equipment. It automatically shuts down the machine when tools need changing. **39**

LEAD BEARING STEEL BARS—Joseph T. Ryerson & Son, Inc., Chicago, Ill. Bulletin 11-1, describing Ledloy, a lead bearing steel, in which chemical composition, mechanical properties, and case studies are given. **40**

REVERBERATORY FURNACES—Eclipse Fuel Engineering Co., Rockford, Ill. Catalogue page C-80-T, describing the new Eclipse soft metal reverberatory furnace in a dry hearth type for aluminum, aluminum alloy, and die-cast metals. . **41**

CHAIN DRIVES—Morse Chain Co., Detroit, Mich. Catalogue C 72-51, giving new data on capacity ratings of Morse Hi-Vo high-speed, heavy-duty chain drives. Installation and lubrication recommendations are also included. . . . **42**

FACE-MILLING CUTTERS AND SHELL END-MILLS—Motch & Merryweather

(Continued on next page)

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Machinery Co., Cutting Tool Mfg. Division, Cleveland, Ohio. Bulletin 101-CT, describing two new series of Kroslok face-milling cutters and shell end-mills—a fine and an extra fine. Standard cutters in both series range in diameter from 3 through 24 inches. A specification sheet is also available. **43**

METAL POWDERS—National Radiator Co., Johnstown, Pa. Bulletin 1, on the subject of powder metallurgy. The general types of metal powders supplied by the Plastic Metals Division of this company are briefly reviewed. **44**

HARD-FACING—Mir-O-Col Alloy Co. Los Angeles, Calif. 72-page pocket-size booklet incorporating technical data and instructions on hard-facing, as well as giving specific information on the Mir-O-Col line of hard-facing metals. **45**

INDUCTION HEATERS—Magnethermic Corporation, Youngstown, Ohio. Bulletin on low-frequency induction heaters made by the company, and giving examples of their use for heating aluminum, magnesium, brass, copper, steel, and titanium. **46**

HARD CHROMIUM-PLATING UNIT—Wagner Brothers, Inc., Detroit, Mich. Folder F 30-54, explaining the Morey process for precision hard chromium-plating, and outlining features of the Wagner Brothers plating unit. **47**

ALLOY FOR ANCHORING MACHINE MEMBERS—Cerro de Pasco Corporation, New York City. Bulletin describing the use of expanding bismuth alloys to anchor bearings, bushings, and non-moving parts in machines. **48**

DIAL FEED UNIT—Sciaky Bros., Inc., Chicago, Ill. Bulletin 319-12 on the Sciaky dial feed—a universal, rotary indexing unit for dial feed applications on resistance welders, machine tools, and various assembly operations. **49**

BUSHINGS—Dodge Mfg. Co., Mishawaka, Ind. Bulletin A-628A, giving technical data on Taper-Lock bushings and hubs for mounting wheels to shafts. Also described are Dodge adapters. **50**

BROACHING—Colonial Broach Co., Detroit, Mich. Booklet C-54, entitled "Chips Tell the Story," considering the broaching process, various types of broaching machines, and surface and internal broaching applications, all with the purpose of telling simply just why and how broaching can produce parts accurately and at high rates of speed. **51**

VALVES—Numatics Operating Valve, Milford, Mich. Bulletin 4010, on Numatics in-line valves having two- and three-way normally open and normally closed actions. **52**

JIG BORERS—Pratt & Whitney Division Niles-Bement-Pond Co., West Hartford, Conn. Circular 576, on the No. 3E Electrolimit jig borer for machining a great variety of shapes and work sizes. Pratt & Whitney's exclusive method of locating the table is explained. **53**

BRAIDED PACKINGS—Garlock Packing Co., Palmyra, N. Y. Bulletin A-131, pointing out the construction features of Garlock lattice-braid rod and shaft packings. There is a table of general recommendations. Included are service reports from users in various industries. **54**

LIVE CENTERS—Sturdimatic Tool Co., Detroit, Mich. Bulletin 654, describing the company's standard and special live centers having a low overhang and a slight cushioning action. **55**

POPPET VALVE WITH ROTARY ACTION—Ross Operating Valve Co., Detroit, Mich. Bulletin 307, describing and illustrating the Ross four-way valve with rotary action, 2 inches high, having poppet type seals. **56**

MOTORIZED SPEED REDUCERS—Falk Corporation, Milwaukee, Wis. Bulletin 3100, comprising 26 pages of concise information on Falk horizontal, vertical, and right-angle Motoreducers. Some typical installations are illustrated. . . **57**

BALL-BEARING SWIVEL JOINTS—Chiksan Co., Brea, Calif. Catalogue G-4, 32 pages, covering the complete line of Chiksan ball-bearing swivel joints and showing their application in various industries. **58**

HAND BROACHING MACHINE—Pioneer Broach Co., Los Angeles, Calif. Folder describing the company's hand broaching machine and showing the type of broach cuts that can be made. . . . **59**

HONING—Micromatic Hone Corporation, Detroit, Mich., Twenty-fifth Anniversary booklet telling the story in 28 illustrated pages, of the concern's progress in the field of honing. **60**

DIAMOND POLISHING COMPOUND—Acme Scientific Co., Chicago, Ill. Bulletin 143, on a diamond compound called Super-Lap, for polishing operations on steel, carbides, and other hard materials. **61**

DRILL JIG BUSHINGS—Ex-Cell-O Corporation, Detroit, Mich. Leaflet on the improved drilling jig bushings manufactured by the company, which are designed for longer wear. **62**

SELF-SETTING CLAMPS FOR PRESSES—Custanite Corporation, Larchmont, N. Y. Leaflet descriptive of the Autoset self-setting clamps for presses and machine tools. **63**

INDICATOR SWIVEL—L. A. Rocheleau Tool & Die Co., Leominster, Mass. Folder descriptive of a fine-adjustment sliding swivel for positioning dial indicators. . **64**

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- *One moving part—balanced spool*
- *Direct operated four way solenoid valve*
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Tomorrow's EnginAIRing Delivered Today

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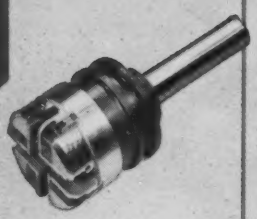
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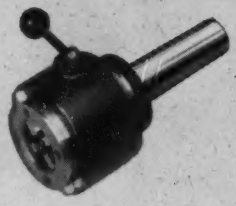
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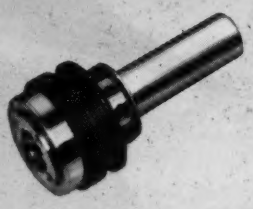
Precision-Pak with die heads and collapsible taps automatically taps holes up to 4" dia., cuts external threads up to 3½" dia.—also bores and reams. Lead accuracy assured by precision lead screw.



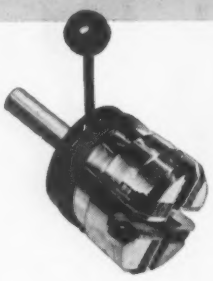
Rotating Die Heads, Type "ORB" with snap action trip and quick change radial type chasers, cut straight threads ⅛" to 5" dia.



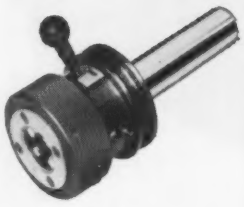
Non-rotating Die Heads, Type "OLB" with pull off snap trip and quick change radial type chasers, cut straight threads ⅛" to 5" dia.



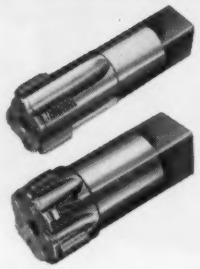
Rotating Die Heads, Type "TRB" with snap action trip and quick change Tangent chasers, cut straight threads ⅝" to 2" dia.



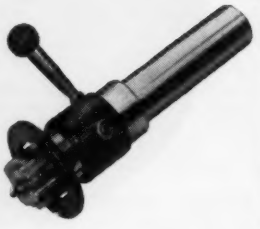
Non-rotating Tangent Die Heads, Type "TLC", with pull-off snap trip and quick change chasers, cut straight threads ¾" to 2" dia.



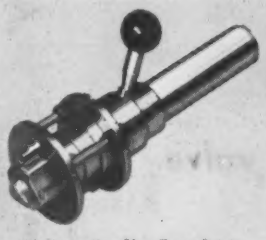
New 4 in 1 Type "ACB" Die Heads, Rotating and Non-Rotating feather action trip, cut straight threads ⅛" to 4" and tapered pipe threads ⅛" to 3½".



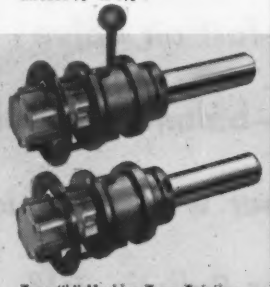
Solid Adjustable Taps "EHB" and "RHB" with removable chasers, cut threads 1¼" to 5" dia.—ideal for salvage work.



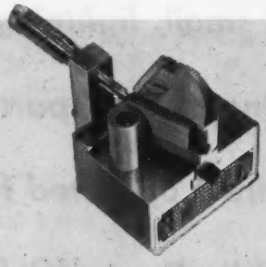
Standard Collapsible Machine Taps, Rotating or Non-Rotating, with easy size adjustment, cut straight threads 1¼" to 7" dia.



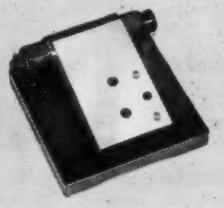
Semi-receding Pipe Taps, Rotating or Non-Rotating, with taper receding action, cut 1" to 6" taper pipe threads. May be arranged for straight threads also.



Type "L" Machine Taps, Rotating or Non-Rotating, with 18 interchangeable nose pieces and 2 bodies, cut a range of straight threads to 6¼" dia.



Tangent Chaser Micrometer Setting Fixture provides longer chaser life and better threads through more accuracy in setting chasers in their holding blocks.



Universal Chaser Grinding Fixture for use on either a surface or cutter grinder assures accuracy in grinding chasers of all types.

For more complete information on Sheffield-Murchey threading tools, get in touch with your local representative or write for Catalog MU-153.

Murchey Division, The Sheffield Corporation
Dayton 1, Ohio, U. S. A.

MASTER CRAFTSMAN SHEFFIELD HEADQUARTERS

SHEFFIELD

6548

For more information on products advertised, use Inquiry Card, page 243



Between Grinds

By E. S. Salichs

A Whirl of a Day

Employes at the L. S. Starrett Co., Athol, Mass., really had themselves a field day on July 17. Besides all kinds of athletic events, entertainment, and food —you could start with clam chowder at 10:30 A.M. and keep right on eating through 2:30 P.M.—holders of 300 lucky numbers enjoyed rides in a helicopter (six at a time, fifty trips). And if you were chicken, you could pass your lucky ticket on to someone else.

Oh, What an Oasis

In the heart of Death Valley, Calif., a single pump installation (a Gorman-Rupp, powered with a 331-cubic inch displacement Chrysler V-8 industrial engine) has transformed the lowest, hottest spot in the United States, according to a news release, into "a tropical rain-kissed Garden of Eden." Furnace Creek Inn, beneficiary of this installation, has a swimming pool and a nine-hole golf course.

Yearning for Uranium?

"Prospecting with a Counter," a U. S. Atomic Energy Commission booklet describing the use of radiation detection instruments in prospecting for uranium ores, is available for 30 cents from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.

Ink, a Shop Kink

Ink that will mark under water—this is the claim of the Organic Products Co. for its No. 400 wet surfaces ink. Now there's no excuse for that mermaid you met on your underseas vacation not to answer your letters!

Masters in Motion

The first museum on wheels, which is carrying a cargo of sixteen precious paintings loaned by Walter P. Chrysler, Jr., is being sponsored by the Virginia Museum of Fine Arts. The curator-driver of the all-aluminum Artmobile expects to stay on the road for two or three years with this particular exhibit.

Bed or Bell Mate

Novel uses of micro switches are of interest to the Minneapolis-Honeywell Regulator Co., which reports the latest — a father of a young sleepwalker installed a switch in the child's bed. When the boy departs on his sleep-walking expeditions, the removal of his weight from the bed closes the switch and sets off an alarm in the parents' room.

Mail Education

American and Canadian youngsters who do not plan to go to college can compete for sixty-four home study scholarships to be granted by International Correspondence Schools on a geographical basis. Write to John C. Villaume, Dean of the Faculty, ICS, Scranton, Pa., for further information.

IN HIGH GEAR—Joseph E. Van Acker, author of the leading article this month beginning on page 153, "Span Measurement of Involute Gear Teeth," was born in Belgium all of thirty-five years ago. He was educated in the United States, and started his career as a teacher of calculus and inspection practice. Mr. Van Acker was then employed by the Wright Aeronautical Corporation for five years, with a two-year interval during which he served in the European Theater as a second lieutenant in the infantry of the United States Army. He joined Gould & Eberhardt, Inc., Irvington, N. J., in 1947, where he is a quality control supervisor and specialist in kinematics of gear generation and gear errors resulting from dynamic machine errors. Mr. Van Acker's hobbies pay off —he designed and built his own home in rural New Vernon, N. J., then turned to cabinet-making, working on build-ins. He also gardens, and to quote him "keeps one step ahead of the deer."



News OF THE INDUSTRY

California, Arizona, and Texas

MERIT PRODUCTS, INC., Culver City, Calif., announces the appointment of the following representatives for its lines of contour sanders and flexible grinding wheels: NORMAN DAHLEY, 329 S. Wood St., Chicago, for Illinois and Wisconsin; HERREN-SIMS CO., 1601 St. Clair Ave., Cleveland, for Ohio and West Virginia; and W. J. HOLTMEIER CO., 71 W. 23rd St., New York City, for the grinding wheels in New York State.

JEROME E. SPRATT has joined the Los Angeles, Calif., staff of Oakite Products, Inc., New York City, manufacturers of industrial cleaning and metal-treating materials. In his capacity of technical service representative, Mr. Spratt will cover east Los Angeles, Alhambra, Glendale, and south Pasadena.

MARVIN WALL and R. C. GAMBLE have been appointed district manager and sales engineer, respectively, for the Heavy Machinery Division, Nordberg Mfg. Co., Milwaukee, Wis., in the Dallas, Tex., territory. Mr. Wall succeeds C. B. TRIMBLE, who recently retired.

JULES F. BOAND, JR., has been named Pacific Coast manager of sales and technical service by the Titanium Metals Corporation of America, New York City. He will have his headquarters at the Los Angeles, Calif., office, which is located at 5333 E. Slauson Ave.

TAPMATIC CORPORATION, Costa Mesa, Calif., manufacturer of tapping attachments, announces the completion of the first unit of its plant, which is located in the Los Angeles area. The plant will eventually occupy an area of 94,000 square feet.

HENRY W. KOESTER, service representative for the Giddings & Lewis Machine Tool Co., Fond du Lac, Wis., was recently transferred from the home office to Los Angeles, Calif., which will be his headquarters for servicing G & L equipment on the West Coast.

H & N MFG. CORPORATION has recently completed its expanded plant facilities at 3525 E. 15th St., Los Angeles, Calif., for the production of All-Flex swivel couplings.

J. L. DEDIEMAR has joined the Resdel Engineering Corporation, Los Angeles, Calif., as chief engineer. Mr. DeDiemar was formerly an electronics project engineer at the Consolidated Vultee Aircraft Corporation.

EXTRUSION DIE LABORATORY is a newly organized concern for the development and manufacture of tooling for the extrusion industry, located at 8022 N. 15th St., Phoenix, Ariz.

WESSENDORF, NELMS & CO., Houston, Tex., has been appointed a distributor by Firth Sterling Inc., Pittsburgh, Pa.

Illinois and Indiana

REAR ADMIRAL LOUIS DRELLER, USN (Retired), has become director of engineering of the Brad Foote Gear Works, Inc., Cicero, Ill., and its two subsidiaries—the Pittsburgh Gear Co., Pittsburgh, Pa.; and the American Gear & Mfg. Co., Lemont, Ill. During his navy career, Admiral Dreller served as chief engineer on a destroyer and an aircraft carrier, as well as carrying out other assignments; most recently he was assistant chief of the office of naval material. He will maintain his headquarters at 1025 Connecticut Ave., Washington, D. C.



Admiral Louis Dreller, USN (Ret.), director of engineering for the Brad Foote Gear Works, Inc.

FOSTER E. FIKE, manager of the Rock Falls, Ill., plant of the Russell, Burdsall & Ward Bolt and Nut Co., Port Chester, N. Y., recently retired. With the company for fifty-three years, Mr. Fike formerly headed the western sales operation from Chicago, later carrying on this assignment from Rock Falls. He will be succeeded by WILLIAM H. HOOFSTITLER, who was formerly assistant manager of the Rock Falls plant.

SALKOVER METAL PROCESSING OF ILLINOIS, INC., announces that it has moved to its new plant at 2550 Edginton Ave., Franklin Park, Ill. The Salkover concern formerly occupied two plants, one at 4209 W. Lake St., Chicago, and the other at 15th and North Aves., Melrose Park, both of which have been discontinued. The company does commercial copper brazing and bright annealing.

CLEARING MACHINE CORPORATION, Chicago, Ill., has opened a direct factory office at 5 St. Paul St., Rochester, N. Y., to serve the upper and western parts of the State. ROBERT J. FALSEY will be in charge of the office. Mr. Falsey has been associated with Clearing since 1935, beginning in the engineering department and most recently being in foreign sales.

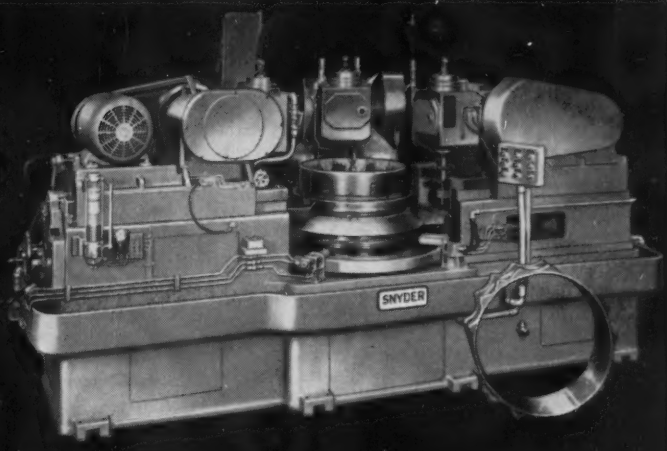
THEODORE F. EICHSTAEDT has been promoted to assistant manager of the machinery and tool division of Joseph T. Ryerson & Son, Inc., Chicago, Ill. He was formerly manager of the machinery and tool department at the Chicago plant. Mr. Eichstaedt has been with Ryerson since 1944.

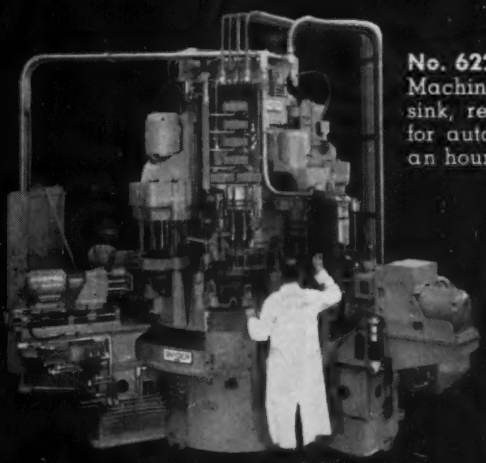
WILTON TOOL MFG. CO., INC., Chicago, Ill., has begun construction of its new general office and factory at 9525 Irving Park Road, Schiller Park, Ill., which will occupy about 65,000 square feet of floor space. The company manufactures manual and automatic vises, work positioners, and C-clamps.

WILLIAM H. OWENS has become manager of the inside sales department of Joseph T. Ryerson & Son, Inc., Chicago, Ill. Mr. Owens, formerly office manager, has been with the company for nine years engaged in both sales and office administrative work. He will now devote his entire time to sales activities.

ROBERT H. WASZ has been appointed director of the merchandise-

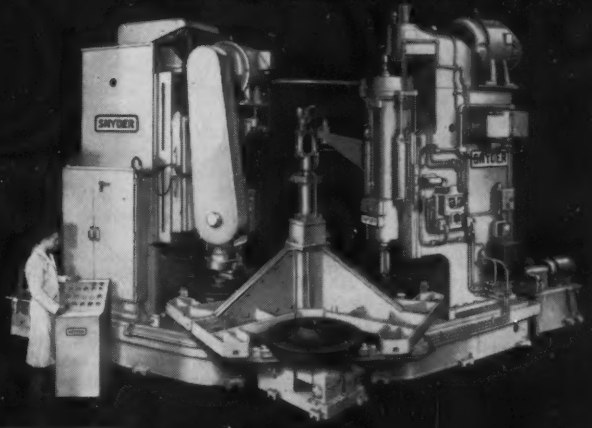
No. 68326—A three-way machine to profile mill four rows of lugs on a compressor casing for jet engines. 135 minutes are used to perform this operation in 3 steps.





No. 62207—Six Station Center Column Machine to drill, counterbore, countersink, ream and tap converter housing for automatic transmissions. 91 pieces an hour at 80% efficiency.

No. 67677—Two-Station, Vertical Column, Boring and Facing Machine to rough bore and face the hub of heavy railroad car wheels. Bore 6¾" x 7" long. 33 units an hour at 100% efficiency.



SPECIALS by SNYDER

TOOL & ENGINEERING COMPANY
3400 E. Lafayette, Detroit 7, Michigan

29 Years of Successful Cooperation with Leading American Industries

procurement division of Joseph T. Ryerson & Son, Inc., Chicago, Ill., steel distributors. Mr. Wasz, who has been with Ryerson since 1942, will have his headquarters at Chicago.

JAMES C. KENEY has been appointed to the sales staff of the Chicago, Ill., district office by the E. W. Bliss Co., Canton, Ohio. Before this, Mr. Keney was engaged in field service and erection of Bliss equipment.

STRONGHOLD SCREW PRODUCTS, INC., has changed its name to the HERCULES FASTENER CORPORATION. This manufacturer of screws, nuts, and rivets is located at 1801 W. Winnemac Ave., Chicago, Ill.

N. W. DORR CO., 3000 W. Washington Blvd., Chicago, Ill., has been named manufacturer's agent by the TAFT-PEIRCE MFG. CO., Woonsocket, R. I., for Chicago, Rockford, and Peoria, Ill., and South Bend, Ind.

JAMES RUSH has joined the sales force of the Electro Refractories & Abrasives Corporation, Buffalo, N.Y., becoming the grinding wheel representative in the Indianapolis, Ind., territory.

Michigan

SHEAR-SPEED CHEMICAL PRODUCTS, DIVISION OF MICHIGAN TOOL CO., Detroit, Mich., has appointed three western distributors, as follows: W. E. ZIEGLER, 3115 W. Third St., Los Angeles, Calif., and L. P. DEGEN BELTING CO., 260 Mission St., San Francisco, Calif., will cover southern and northern California, respectively; and CHEMICAL SALES CO., 1125 Seventh St., Denver, Colo., will handle sales of Shear-Speed soluble oil in Colorado.

DETROIT TAP & TOOL CO., Base Line, Mich., has been appointed a distributor by AUTOMATIC METHODS INC., Elizabeth, N. J. The distributor will handle sales and service of Auto-Tap lead-screw tapping tools in Ohio, Indiana, Michigan, northern Illinois, Wisconsin, eastern Iowa, and California. Also announced was the appointment of the B. C. MACDONALD CO., St. Louis, Mo., as distributor in Missouri, southern Illinois, Kansas, Nebraska, and western Iowa.

PAUL H. MILLER has joined the Wesson Co., Detroit, Mich., manufacturer of carbide cutting tools, in the capacity of assistant to the vice-president in charge of research and development. Mr. Miller, a research engineer, was for many years with the Carboloy Department of General Electric Co., serving as manager of design and application. In his new post at Wesson, he will assist in the creation of tools and products for new metal-working applications. He will also conduct research on applications of carbide tooling.

STEWART BARTON, central district manager and assistant sales manager for the Fellows Gear Shaper Co., Springfield, Vt., with headquarters at Detroit, Mich., will now devote full time to his duties as assistant sales manager there. ARTHUR TOBIN, who was in the New York office, will succeed Mr. Barton as central district manager.

WALTER E. JONES, who was a metallurgical development engineer at the Thomson Laboratory of the General Electric Co., Lynn, Mass., has been appointed manager of vacuum melted products engineering at the Carboloy Department of General Electric Co., Detroit, Mich. Mr. Jones joined G-E in 1941.

HOWARD J. EVANS and H. A. ALTORFER have been appointed chief engineers and managers of two new central departments by the Rockwell Mfg. Co., Pittsburgh, Pa.—the gas products research and development department and the valve research and development department, respectively.

EDWIN A. SWENSSON has been named sales and service engineer by the Herman Pneumatic Machine Co., Pittsburgh, Pa. Mr. Swensson, whose office is at 2970 W. Grand Blvd., Detroit, will cover Michigan; Toledo, Ohio; and Windsor and Sarnia, Ontario, Canada.

O. T. THOMPSON has been named assistant branch manager of the Detroit territory by the Carpenter Steel Co., Reading, Pa. Mr. Thompson, who was a sales engineer in the Detroit area, will continue to have his headquarters at the company's Detroit mill-branch warehouse.

JOHN LAWRENCE has been elected executive vice-president of the Joy Mfg. Co., Pittsburgh, Pa. Mr. Lawrence, who has been with the company since 1951, was named vice-president of manufacturing and engineering last year.

PAUL A. MILLER has joined the Ford Motor Co. in the capacity of manager, manufacturing-engineering, in the Parts and Equipment Division, Ypsilanti, Mich. Mr. Miller was formerly vice-president of the Leece-Neville Co., Cleveland, Ohio.

MORSE CHAIN CO., Detroit, Mich., has appointed three new distributors: MANUFACTURERS EQUIPMENT & SUPPLY CO., Flint, Mich.; SCHUMAN STEEL PRODUCTS CO., Bellingham, Wash.; and JACK LEE MACHINE & SUPPLY CO., Attalla, Ala.

TRACER CONTROL CO., Hazel Park, Mich., has purchased from the Lodge & Shipley Co., Cincinnati, Ohio, the contour machining duplicator for which it has been the distributor. The device has been named the "Duplimatic."

WILLIAM J. FABISH has been appointed eastern representative for Hammond Machinery Builders, Inc., Kalamazoo, Mich., builders of Duskolectors and grinding, polishing, buffing, and deburring machinery.

TAFT-PEIRCE MFG. CO., Woonsocket, R. I., announces the removal of its Detroit sales office from 10700 Puritan Ave. to 10243 Puritan Ave., Detroit 38, Mich.

EARL A. OLDHAM will represent the Lufkin Rule Co., Saginaw, Mich., in San Francisco, northern California, and Nevada.

New England

DONALD A. COMES, general sales manager of the Farrel-Birmingham Co., Inc., Ansonia, Conn., has been elected vice-president. He will also continue to hold his present position of general sales manager. Mr. Comes has been with the company since 1922 in various sales capacities.



Donald A. Comes, vice-president of Farrel-Birmingham Co., Inc.

ALFRED SONNTAG is resigning as manager of the Sonntag Scientific Corporation, a division of the Baldwin-Lima-Hamilton Corporation, in order to devote his time more exclusively to the Alpha Corporation, Greenwich, Conn., of which he is president.

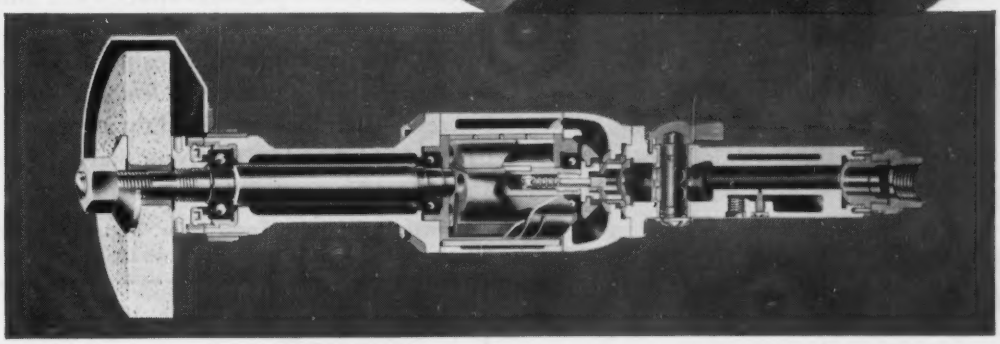
FREDERICK H. FIPPINGER has been appointed New England sales representative by the Cushman Chuck Co.,

(*Continued on page* 257)

With New Departures—
ROTOR GIVES UPKEEP THE "AIR"!



Rotor Tool Company design utilizes three New Departure **ball** bearings. Front bearing is wider to give greater surface on shaft and housing to withstand vibratory loads.



Holding the line against maintenance downtime! Three New Departures in the Rotor Tool air grinder need no adjustment . . . cut lubrication requirements to virtually zero.

These New Departure double-shielded bearings are protected from foreign matter. They have the high capacity to carry radial and thrust loads . . . to withstand the shocks of hard use and rough handling. At the same time, cool-running New Departure **ball** bearings maintain accurate alignment and assure maximum power at the grinding wheel.

You can build these advantages into *your* product, too. Talk with your New Departure engineer—*today!*



NEW DEPARTURE
BALL BEARINGS

NEW DEPARTURE • DIVISION OF GENERAL MOTORS • BRISTOL, CONNECTICUT
Plants also in Meriden, Connecticut, and Sandusky, Ohio
In Canada: McKinnon Industries, Ltd., St. Catharines, Ontario

For more information on products advertised, use Inquiry Card, page 243

140 NEW MODELS

to Meet Every Quality Control Requirement



Starrett

HIGH PRECISION — LOW FRICTION

DIAL INDICATORS

(Patents Pending)

In this *new* line of dial indicators, Starrett offers you a *truly complete* selection . . . 140 models to meet every need. Consider the advantages of buying *all* dial indicators from one reliable source . . . uniform standards of precision; simplified purchasing; greater accuracy, sensitivity and durability in all dial indicators through new *high precision — low friction* design . . . plus less upkeep and minimum maintenance through simplified unit construction and interchangeable parts. Get the whole story on this *complete new* line of Starrett Dial Indicators. Send the coupon today for information on *New* Starrett Dial Indicators.

Send the Coupon Today for information on Starrett *High Precision — Low Friction* Dial Indicators.

THE WORLD'S MOST COMPLETE LINE

Precision built throughout to American Gage Design specifications, these *new* Starrett Dial Indicators are available in *Regular* or *NON-SHOCK* types, with balanced or continuous dials, jeweled or plain (inserted bronze) bearings, English or Metric graduations . . . in all four standard A.G.D. groups plus a complete series of *long range* models.

THE L. S. STARRETT COMPANY, Dept. D
Athol, Massachusetts

Please send information on Starrett *High Precision — Low Friction* Dial Indicators.

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Company.....

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"WORLD'S GREATEST TOOLMAKERS"

STARRETT TOOLS

MECHANICS' HAND MEASURING TOOLS AND PRECISION INSTRUMENTS · DIAL INDICATORS · STEEL TAPES PRECISION GROUND FLAT STOCK · HACKSAWS, BAND SAWS and BAND KNIVES

THE L. S. STARRETT COMPANY, ATHOL, MASSACHUSETTS, U. S. A.

MACHINERY'S DATA SHEETS 761 and 762

WROUGHT ALUMINUM ALLOY DESIGNATION CONVERSIONS — 1

Developed by The Aluminum Association, to be Effective October 1, 1954

Previous Commercial Designation	New Aluminum Association Number	Previous Commercial Designation	New Aluminum Association Number	Previous Commercial Designation	New Aluminum Association Number	Previous Commercial Designation	New Aluminum Association Number
99.3*	1230	3S	3003	A50S, K155, R305	5005	72S	7072
99.6, CD1S	1160	4S	3004	XD50S	X5405	75S	7075
99.75†	1175	XA5S	X3005	A51S	6151	B77S	7277
99.87, EB1S	1187	11S	2011	XB51S	X6251	XA78S	X7178
EC‡	EC	14S, R301 Core	2014	J51S, K160	6951	XB80S	X8280
AA1S	1095	XB14S	X2214	52S	5052	K112	8112
BA1S	1099	XC16S	X2316	F52S	5652	K143, C43S, 44S	4343
CA1S	1197	17S	2017	53S	6053	K145, 43S	4043
AB1S	1085	A17S	2117	B53S	6253	K55, A50S, R305	5005
EB1S, 99.87	1187	18S	2018	XD53S	X6453	K157, C57S	5357
FB1S	1090	B18S	2218	E53S	6553	K160, J51S	6951
AC1S	1070	F18S	2618	A54S	5154	K162, R306§	6003
BC1S	1080	24S	2024	B54S	5254	LK183	5083
CC1S, R998	1180	25S	2025	X55S	X5055	K186	5086
JC1S	1075	B25S	2225	56S	5056	R301 Core, 14S	2014
AD1S	1050	32S	4032	XC56S	X5356	R305, K155, A50S	5005
BD1S	1060	43S, K145	4043	C57S, K157	5357	R306, K162§	6003
CD1S, 99.6	1160	C43S, 44S, K143	4343	61S	6061	R308¶	1130
ED1S	1150	XE43S	X4543	62S	6062	R399	8099
AE1S	1030	44S, C43S, K143	4343	63S	6063	R995	1235
BE1S	1145	45S	4045	66S	6066	R998, CC1S	1180
2S	1100	50S	5050	70S	7070	....	....

*Cladding on Alclad 24S (Alclad 2024). †Cladding on No. 2 Reflector Sheet. ‡EC — The designation for electrical conductor metal has not been changed since it is so firmly established in the electrical industry. §Cladding on R301 and Alclad 14S (Alclad 2014). ¶No. 1 Reflector Sheet.

MACHINERY'S Data Sheet No. 761, September, 1954

WROUGHT ALUMINUM ALLOY DESIGNATION CONVERSIONS — 2

Developed by The Aluminum Association, to be Effective October 1, 1954

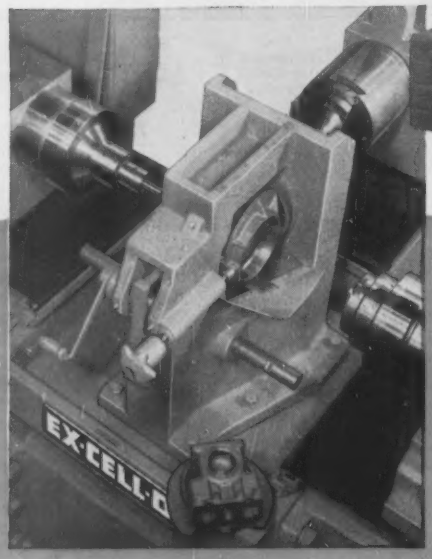
New Aluminum Association Number	Previous Commercial Designation	New Aluminum Association Number	Previous Commercial Designation	New Aluminum Association Number	Previous Commercial Designation	New Aluminum Association Number	Previous Commercial Designation
EC*	EC	1197	CA1S	4043	43S, K145	6061	61S
1030	AE1S	1230§	99.3	4045	45S	6062	62S
1050	AD1S	1235	R995	4343	C43S, 44S, K143	6063	63S
1060	BD1S	2011	11S	X4543	XE43S	6066	66S
1070	AC1S	2014	14S, R301 Core	5005	A50S, R305, K155	6151	A51S
1075	JC1S	2017	17S	5050	50S	X6251	XB51S
1080	BC1S	2018	18S	5052	52S	6253	B53S
1085	AB1S	2024	24S	X5055	X55S	X6453	XD53S
1090	FB1S	2025	25S	5056	56S	6553	E53S
1095	AA1S	2117	A17S	5083	LK183	6951	J51S, K160
1099	BA1S	X2214	XB14S	5086	K186	7070	70S
1100	2S	2218	B18S	5154	A54S	7072	72S
1130†	R308	2225	B25S	5254	B54S	7075	75S
1145	BE1S	X2316	XC16S	X5356	XC56S	X7178	XA78S
1150	ED1S	2618	F18S	5357	C57S, K157	7277	B77S
1160	CD1S, 99.6	3003	3S	X5405	XD50S	8099	R399
1175‡	99.75	3004	4S	5652	F52S	8112	K112
1180	CC1S, R998	X3005	XA5S	6003¶	R306, K162	X8280	XB80S
1187	EB1S, 99.87	4032	32S	6053	53S	....	....

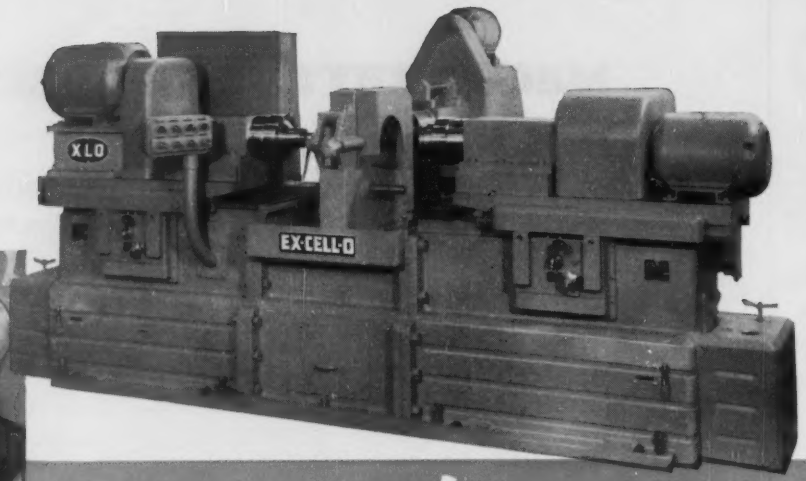
*EC — The designation for electrical conductor metal has not been changed since it is so firmly established in the electrical industry. †No. 1 Reflector Sheet. ‡Cladding on No. 2 Reflector Sheet. §Cladding on Alclad 2024 (Alclad 24S). ¶Cladding on Alclad 2014 (R301 and Alclad 14S).

MACHINERY'S Data Sheet No. 762, September, 1954

Ex-Cell-O 3-Way Precision Boring Machine. Standard way units—tooled to suit the work.

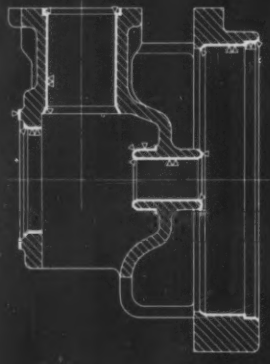
Note the simplicity of this tooling.





Cut Costs—Combine Operations

. . . INSURE YOUR PROFITS in Today's Competitive Market



Heavy lines show the machined surfaces. Small single triangles indicate single operations; double triangles indicate rough-and-finish operations.

Once a part is properly located and clamped, it's good practice to do as much machining on it as possible before it's moved! Related dimensions are held closer, handling time minimized and production increased.

This Ex-Cell-O 3-Way Precision Boring Machine performs 5 roughing and 18 finishing operations on a cast-iron crankcase used in the refrigeration industry. Tolerances are extremely close on the crankshaft and cylinder bores. Net production for the roughing operation is 33 parts per hour; for finishing, 36 parts per hour.

Ask your local Ex-Cell-O representative about all the other advantages of Ex-Cell-O Way Machines—or write today for Bulletin.

XLO
EX-CELL-O for PRECISION

EX-CELL-O CORPORATION

DETROIT 32, MICHIGAN

MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING SPINDLES • CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

54-30

Hartford, Conn., manufacturer of air and manually operated chucks. Mr. Fippinger has been with Cushman since 1936, and for the last eight years was factory manager.

WALTER ST. ONGE, JR., has been named advertising manager of the Torrington Co., Torrington, Conn., succeeding his father, who is retiring after thirty-one years of service with the company.

EUGENE PARKS was recently named president of the Fonda Gage Sales Corporation, Stamford, Conn.

POTTER & JOHNSTON CO., Pawtucket, R. I., subsidiary of Pratt & Whitney Division Niles-Bement-Pond Co., West Hartford, Conn., has taken over the manufacture of products formerly made by NEWARK GEAR, INC., Newark, N. J. These products include gear hobbing, cutting, and testing machines, gear cutter grinding machines, and attachments for these machines. Sales and service for the Newark Gear machines will be handled by the Pratt & Whitney Sales Division.

COWAN SUPPLY CO. has been appointed manufacturer's agent in Georgia for the Taft-Peirce Mfg. Co., Woonsocket, R. I. The Cowan concern, which is located at 124 Walker St., S. W., Atlanta, Ga., will handle the Taft-Peirce lines of gages, magnetic chucks, and tool-room equipment.

HERBERT A. SILVEN, a machine designer with the Norton Co., Worcester, Mass., since 1916, has been appointed head of the engineering department. He succeeds CARL G. FLYGARE, a grinding development engineer who retired recently after forty-seven years of service. With Norton since the age of fifteen, Mr. Flygare held many positions, including those of draftsman, designer, supervisor, and design engineer, before being appointed head of the engineering department. Both men have many patents to their credit.

New York

CHARLES C. ATWELL, heading his own company, the C. C. Atwell Co., 50 Church St., New York City, will be manufacturers' representative for the THREADWELL TAP & DIE CO., Greenfield, Mass., and LAVALLEE & IDE, INC., Chicopee, Mass. His territory will include the New York Metropolitan area for both; and, in addition, Long Island and northern New Jersey for Threadwell; and New Jersey, Baltimore, and Philadelphia for Lavallee & Ide.

JOSEPH TYODI has been named factory sales representative for western New York State by the Axelson Mfg. Co. Division, Pressed Steel Car Co., Inc., Los Angeles, Calif. Mr. Tyodi has been associated with Axelson in various capacities for the last seven years.

I. WENDELL HAMM has joined the Carborundum Co., Niagara Falls, N. Y., in the capacity of director of manufacturing. Mr. Hamm was formerly chief of industrial engineering in the Nylon Division of E. I. du Pont de Nemours & Co., Inc., at Seaford, Del.

CHARLES E. SCHELL has been named assistant to the plant manager of John Volkert Metal Stampings, Inc., Queens Village, N. Y. Mr. Schell was formerly with Sylvania Electric Products, Inc.

RICHARD R. SENZ, staff metallurgist at the Cleveland, Ohio, works of the Aluminum Company of America, Pittsburgh, Pa., has been transferred to the Buffalo, N. Y., works, becoming chief metallurgist there.

A. L. COULSON was recently appointed assistant sales manager of the Ford Instrument Co., Division of the Sperry Corporation, Long Island City, N. Y.

METALLIZING ENGINEERING CO., INC., has moved its Eastern office and factory from Long Island City to 1101 Prospect Ave., Westbury, Long Island, N. Y.

Ohio

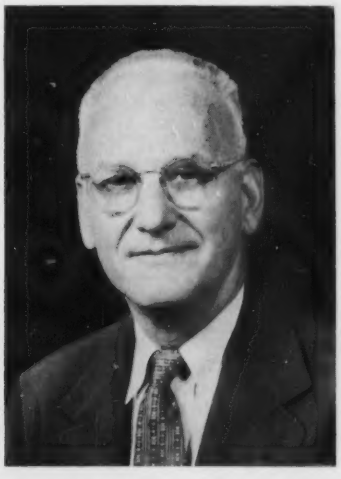
JAMES W. DICKEY, executive vice-president of the Ohio Hoist & Mfg. Co., Cleveland, Ohio, and Alcaloy, Inc., Trenton, N. J., has been named president of both organizations. These companies belong to the Round Chain Division of the Republic Steel Corporation.

LATROBE STEEL CO., Latrobe, Pa., recently completed a warehouse in the Cleveland area devoted to tool and die steels. The address is 5572 Brecksville Road, Independence, Ohio.

BRUSH ELECTRONICS CO., Cleveland, Ohio, Division of Clevite Corporation has announced the purchase of the DIGITAL INSTRUMENT CO., Coral Gables, Fla., manufacturer of electronic counters.

ARCHIE F. WILSON has joined the Hydraulic Press Mfg. Co., Mount Gilead, Ohio, in the capacity of director of manufacturing. Prior to this, he was manager of plant operations at the Mather Stock Car Co., Chicago, Ill.





(Left) Carl G. Flygare, who is retiring as head of the engineering department at the Norton Co.; and (right) Herbert A. Silven, who is assuming this position



Archie F. Wilson, new director of manufacturing at the Hydraulic Press Mfg. Co.





(Left) Raymond D. Lindstrom, newly elected vice-president—manufacturing, National Tool Co.; and (right) Joseph B. Clough, vice-president—sales

RAYMOND D. LINDSTROM and JOSEPH B. CLOUGH were recently elected vice-presidents of the National Tool Co., Cleveland, Ohio,—of manufacturing and sales, respectively. Mr. Lindstrom joined the company in 1947 as assistant factory manager, and two years later was promoted to factory manager. Mr. Clough has been director of sales for the National Tool Co. since 1950. Prior to that, he was vice-president and part owner of the Godfrey Tool & Supply Co.

HYDRAULIC PRESS MFG. CO., Mount Gilead, Ohio, announces the appointment of the following distributors: MINE & SMELTER SUPPLY CO., Denver, Colo., and El Paso, Tex.; and TODD MACHINERY CO., Salt Lake City, Utah.

CARL W. LARRICK, production control manager of the Morris Machine Tool Co., Cincinnati, Ohio, has been promoted to the post of works manager.

Pennsylvania

CONTROL PRODUCTS CO., INC., Noblestown Road, Oakdale, Pa., is a newly organized company which will design and manufacture automatic control systems for the steel, nonferrous, electrical, oil, chemical, and other process industries. WALLACE E. POWELL is president. He was formerly a control systems engineer for the Jones & Laughlin Steel Corporation.

DOUGLAS R. BEGGS, formerly director of personnel at the Carpenter Steel Co., Reading, Pa., has been appointed assistant to the vice-president—production. Mr. Beggs joined Carpenter in 1932 as a machinist apprentice. Before becoming director of personnel, he was also a time study engineer and director of time study. HAROLD W. MILLER, who was assistant general superintendent, has been advanced to chief plant engineer. Mr. Miller joined the company as a chemist in 1937. Also announced was the appointment of R. A. KOKAT, a sales engineer in the Philadelphia area, as assistant branch manager there. His headquarters will be at the company's office, 29 Bala Ave., Bala-Cynwyd, Pa.

FIRTH STERLING, INC., Pittsburgh, Pa., has appointed four distributors in the Midwest and Southeast: K. P. WESSELING Co. in the St. Louis area; CINCINNATI SUPPLY CO., INC., in the Cincinnati area; NOLAND CO., INC., Norfolk, Va., and its branches, for the South; and PHOENIX STEEL SUPPLY CO., throughout the Midwest, and primarily in the Chicago area.

FRED W. EMHARDT has been appointed chief engineer of the Struthers Wells Corporation, Warren Division, Warren, Pa. He has been with the corporation since 1936, most recently as assistant manager of the process equipment department.

JAMES A. MCGOWAN, assistant product manager at the Vernon Calif., works of the Aluminum Co. of America, Pittsburgh, Pa., is becoming assistant district sales manager of the New York district. WILLIAM F. COURTER, who was in the Los Angeles district sales office, will succeed Mr. McGowan at the Vernon works.

FOLLANSBEE METAL WAREHOUSES, a division of Follansbee Steel Corporation, Pittsburgh, Pa., has adopted a new name—FOLLANSBEE METALS. This warehouse, located at Gateway Center in Pittsburgh, serves Pittsburgh, Rochester, N. Y., and Wallingford, Conn.

JOHN H. PETTIT has been appointed sales agent in eastern Canada for the Alloy Tube Division of the Carpenter Steel Co., Union, N. J. Mr. Pettit is located at Gardenvale, Quebec.

WALTER E. GREGG has been named vice-president and assistant general manager at Rem-Cru Titanium, Inc., Midland, Pa., while DR. WALTER L. FINLAY has been made vice-president and manager of research.

C. WALKER JONES CO., Philadelphia, Pa., which manufactures Jomac work gloves, has changed its name to JOMAC, INC. Also announced was the change of its official street address to 6135 N. Lambert St.

SIZE CONTROL CO., Chicago, Ill., gage manufacturer, has appointed the TOOL ENGINEER PRODUCTS CO., INC., Pittsburgh, Pa., representative for western Pennsylvania.

ENAMELSTRIP CORPORATION, Allentown, Pa., has begun construction of a plant addition which will more than double its facilities.

Wisconsin, Minnesota, and Missouri

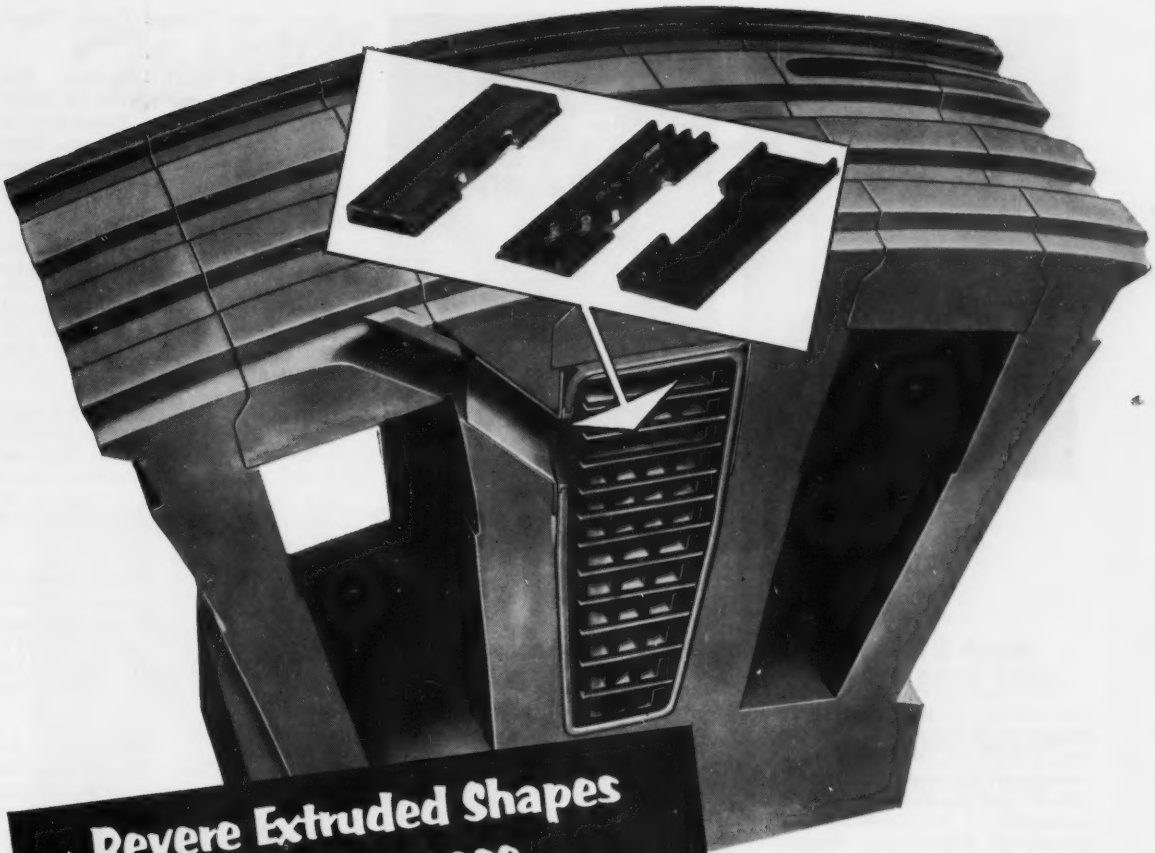
GEORGE E. GERNON, secretary of the Gisholt Machine Co., Madison, Wis., has retired as an active member of the board of directors, although he will continue as secretary, a position he had held for the last forty-nine years of his fifty-four years of service with Gisholt. HOWELL W. MURRAY has been elected to the board. He is vice-president of A. G. Becker & Co., Chicago, Ill.

MILWAUKEE METAL WORKING CO., Milwaukee, Wis., has changed its name to WISCONSIN HYDRAULICS, INC. The company manufactures hydraulic motors, pumps, valves, and cylinders.

HARRY J. DUFFY has been appointed manager of sales in Wisconsin, Minnesota, and Michigan for the Trent Tube Co., East Troy, Wis. His headquarters will be at East Troy.

FRED F. STORMS has been appointed western sales manager for the Star Machine & Tool Co., Minneapolis, Minn.

ONSRUD MACHINE WORKS, Chicago, Ill., have appointed the TOOL BOX SALES CO. their metal-working machinery representative in the St. Louis area. The representative is located at 1356 Kingsland Ave., St. Louis, Mo.



Revere Extruded Shapes help increase ELECTRIC GENERATOR OUTPUT

(perhaps you, too, could use our shapes to your advantage)

Model section of G.E. direct-cooled rotor for turbine-generator. Note intake scoop at left front, hollow copper conductors of extruded shapes, in center, exhaust outlet at right rear.

Insert shows typical extruded shapes after milling by G.E. to provide circulation of hydrogen throughout the field coils.

Winding temperatures are an important limitation upon the output of electric utility generators. They must be kept within safe limits to avoid damaging the insulation. Hence all generators have some method of cooling. Conventionally, the heat passes from the copper conductors in the rotor, through the insulation (which presents a formidable barrier to heat transfer) to the steel parts of the rotor body, and air or hydrogen is pumped through and around the rotor. It was realized long ago that more effective cooling could be obtained if some way could be found to remove the heat directly from the rotor coils.

Some years ago generator engineers of the General Electric Company, Schenectady, New York, proposed making each turn of the rotor coils of two copper extruded shapes; one a channel, the other comb-like. Fitted together, they would make hollow passages for the hydrogen, which would be taken in through scoops on the surface of the rotor, and exhausted through outlets some distance away, also on the rotor surface. In that way, the rotor could be quite uniformly and more effectively cooled throughout its length, and output greatly increased in relation to the physical dimensions of the generator.

An important problem was found in the extruded shapes. Design requirements had to be adjusted to the opportunities and practicalities of the extrusion process. Today these copper shapes, 20 feet long, drawn and finished to strict specifications as to dimensions and straightness, are making it possible to remove four times as much heat as conventional systems, and to double the generator output with no increase in size... For full information on extruded shapes, see the nearest Revere Sales Office.

REVERE

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

230 Park Avenue, New York 17, N. Y.

• • •

Mills: Baltimore, Md.; Chicago and Clinton, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Rome, N. Y.— Sales Offices in Principal Cities, Distributors Everywhere.

SEE "MEET THE PRESS" ON NBC TELEVISION, SUNDAYS

For more information on products advertised, use Inquiry Card, page 243





(Left) E. Franklin Motch, president and treasurer of Motch & Merryweather Machinery Co.; and (right) George E. Merryweather, vice-president and secretary

Motch & Merryweather Celebrates 50th Anniversary

This month marks the fiftieth anniversary of the founding of the Motch & Merryweather Machinery Co., Cleveland, Ohio. The founders, George E. Merryweather, Edwin R. Motch, and Stanley Motch, were all graduates of the Massachusetts Institute of Technology, and served their apprenticeships in eastern metal-working plants. In 1904, they formed a company with headquarters in Cleveland to serve as distributors of machine tools, representing leading machine tool builders in Ohio and eastern Michigan. This area was later expanded to include western Pennsylvania, Kentucky, and part of Maryland, and branch offices were established in Detroit, Pittsburgh, Cincinnati, and Dayton.

From an original staff of four employes, the roster has grown to 500 employes. The company operates six divisions, the largest of which is the Machine Tool Distributor Division.

Coming Events

SEPTEMBER 14-23—FOURTH EUROPEAN MACHINE TOOL EXPOSITION to be held in Milan, Italy, promoted by the European Committee for Cooperation of Machine Tool Industries. For further information write to the Committee, care of Unione Costruttori Italiani Macchine Utensili, Via Domodossola, Milan, Italy.

SEPTEMBER 21-23—Annual meeting and exhibition of the SOCIETY FOR EXPERIMENTAL STRESS ANALYSIS in conjunction with the First International Instrument Congress and Exposition, to be held at the Bellevue-Stratford Hotel, Philadelphia, Pa. Write to the general chairman, Frank G. Tatnall, Box 4034, Chestnut Hill, Philadelphia 18, Pa.

SEPTEMBER 28-OCTOBER 1—Twenty-eighth Iron and Steel Exposition and Annual Convention of the ASSOCIATION OF IRON AND STEEL ENGINEERS to be held at the Public Auditorium, Cleveland, Ohio. T. J. Ess, managing director, 1010 Empire Bldg., Pittsburgh 22, Pa.

OCTOBER 1-2—Annual meeting of the STANDARDS ENGINEERS SOCIETY at Haddon Hall, Atlantic City, N.J. Secretary, F. M. Oberlander, Box 281, Camden, N. J.

OCTOBER 14-15—TENTH ANNUAL NATIONAL CONFERENCE ON INDUSTRIAL HYDRAULICS to be held at the Sheraton Hotel, Chicago, Ill. For further information, write to the Illinois Institute of Technology, 35 W. 33rd St., Chicago 16, Ill.

OCTOBER 21-23—Eighth New England Conference of the AMERICAN SOCIETY FOR QUALITY CONTROL at the Ten Eyck Hotel, Albany, N. Y. For additional information, write to Southern Connecticut Section, A.S.Q.C., Box 1681, Bridgeport 1, Conn.

OCTOBER 24-27 — Semi-annual meeting of the AMERICAN GEAR MANUFACTURERS ASSOCIATION, at the Edgewater Beach Hotel, Chicago, Ill. Executive secretary, John C. Sears, One Thomas Circle, Washington 5, D. C.

OCTOBER 25-27—Machine Tool Conference of the AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS at the Statler Hotel, Detroit, Mich. For further information, contact the Institute, 33 W. 39th St., New York 18, N. Y.

NOVEMBER 1-5—Thirty-sixth National Metal Exposition sponsored by the AMERICAN SOCIETY FOR METALS at the International Amphitheatre, Chicago, Ill. Secretary, W. H. Eisenman, 7301 Euclid Ave., Cleveland 3, Ohio.

NOVEMBER 1-5—National fall meeting of the AMERICAN WELDING SOCIETY to be held at the Sherman Hotel, Chicago, Ill. Further details can be obtained by writing to the Society, 33 W. 39th St., New York 18, N. Y.

NOVEMBER 29-DECEMBER 2—First INTERNATIONAL AUTOMATION EXPOSITION to be held at the 244th Regiment Armory, New York City. For further information, write to Exposition, 845 Ridge Ave., Pittsburgh 12, Pa.

DECEMBER 2-7—Twenty-first National Exposition of Power and Mechanical Engineering under the auspices of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS, at the Commercial Museum, Philadelphia, Pa. Manager, Charles F. Roth, 480 Lexington Ave., New York 17, N. Y.

* * *

Jones & Lamson and C.I.T. Announce Marketing Service

Machine tool users who desire new equipment but lack the cash purchase price have been offered flexible financing and leasing plans by the Jones & Lamson Machine Co., Springfield, Vt. Merchandising programs worked out with the C.I.T. Corporation, an industrial financing firm, feature a true lease plan running for periods of up to nine years and an installment plan with five-year terms. Also available is a leasing plan with an option to buy. With each plan a 10 per cent deposit is required which will be refunded to the customer when the transaction has been fulfilled.

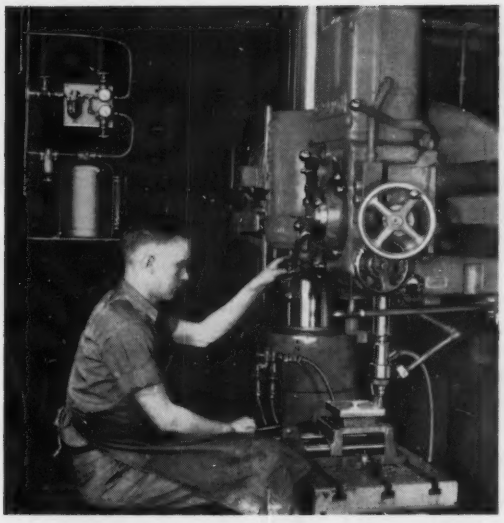
The true lease plans do not include an option to purchase either at a stated time or at a fixed amount. However, the user can make an offer at any time to purchase the equipment at a fair market value. There is no obligation on the part of the user to buy, and there is no agreement by Jones & Lamson to sell. Therefore, the plans are true leases and all rental payments are deductible for income tax purposes.

Norgren

Spray-Lube *System*

ON RADIAL DRILL TAPPING HOLES IN 1⅛" ALLOY STEEL

at O. K. RUBBER, INC.



- more than doubled tap life
- increased tap speed 38%
- improved quality of tapped hole
- eliminated the "mess" and excessive coolant cost of flood method

and

- *paid for itself in one month in machine cleaning time alone*

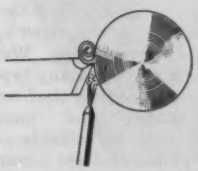
WRITE FOR DETAILS IN NORGREN BLUEPRINT SL-3

NORGREN SPRAY-LUBE SYSTEM

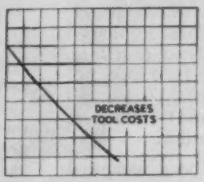
An Automatic, Air-Powered System for More Efficient Single or Multi-Point Application of Cutting Liquids to Metal Cutting and Forming Operations! For Tapping Machines, Drill Presses, Lathes, Milling Machines, Grinders, Stamping Presses, Boring Mills, Deep Draw Presses and Other Metal Working Machines.

NEW ADVANTAGES THAT ARE PRODUCING SPECTACULAR RESULTS ON PRODUCTION LINES

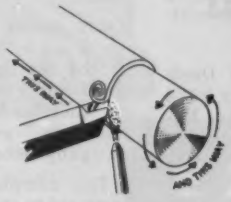
COOLANT WHERE YOU NEED IT COOLS FASTER



LONGER TOOL LIFE— LESS "DOWNTIME"



FASTER CUTTING SPEEDS AND FEEDS



SAVES ON LIQUID CONSUMPTION AND RECLAIMING PROCESSES



C. A. Norgren CO.
3419 So. Elati, Englewood, Colo.

PIONEER AND LEADER IN OIL-FOG LUBRICATION FOR 26 YEARS

VALVES • FILTERS • HOSE ASSEMBLIES • REGULATORS • LUBRICATORS

New Books and Publications

BETTER TOOL CRIBS. By William Raisglid. 152 pages, 6 by 9 inches; 85 illustrations. Published by THE INDUSTRIAL PRESS, 148 Lafayette St., New York 13, N. Y. Price, $4.

This book was written to demonstrate that there *is* a way to avoid confusion and wasteful methods of conducting tool-crib functions, and that production gains to be derived from a well-organized crib are great enough to demand attention from all concerned with its operation.

The information presented is based on sound practice. By means of profusely illustrated descriptions, the author shows in detail how such items as milling cutters, honing units, counterbores, fly cutters, measuring tools, gages, machine parts, and other shop tools and materials should be stored. In addition, several complete control systems based on the use of brass tool checks and triplicate tool charge slips are clearly described. The lay-out of a complete tool crib is taken up in step-by-step fashion to show how maximum benefits can be derived from proper location of the various pieces of storage equipment and the tools and materials located therein. The smallest details of how to store tools and materials—and how to maintain proper control over these items—are thoroughly covered.

Chapter headings of the book are as follows: Location and Lay-Out of Tool Cribs; Methods of Storing Tools, Machine Parts, and Materials; Grouping and Storing Small Tools; Display Boards and Racks for Tool Storage; Brass Tool Check Systems; Improving Brass Tool Check Systems; Helpful Tips on Handling Tools and Materials; Records that Must be Kept; Tool Charge-Slip Control Systems; Marking Systems for Tool Cribs; Special Sections in the Tool Crib; and Central Tool Crib and Sub-Cribs.

The numerous halftone illustrations and line diagrams, in addition to several tables, should be of practical value either in setting up a new tool crib or improving an existing one.

PRACTICAL GEAR DESIGN. By Darle W. Dudley. 335 pages, 6 by 9 1/4 inches. Published by the McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 36, N. Y. Price, $7.

The author of this book is in charge of gear development in the Gear Engineering Division of the General Electric Co. Writing with the general engineer or technician in mind, rather than the gear specialist, he has endeavored to give thorough information in practical form for all concerned with the design, manufacture, and use of gears. The scope of the work includes the geometry of gear design, manufacturing methods, and causes of gear installation failures.

There are eight chapters. Chapter 1, Gear-Design Trends, deals with manufacturing trends and selection of the right kind of gear; Chapter 2, Preliminary Design Considerations, presents stress formulas, preliminary estimate of gear size, and data requested for gear drawings; Chapter 3, Design Formulas, is divided into two parts—Calculation of Gear-Tooth Data, and Gear-Rating Practice; Chapter 4, Gear Materials, considers steels for gears, localized hardening of gear teeth, cast irons for gears, non-ferrous gear metals, and non-metallic gears; Chapter 5, Gear-Manufacturing Methods, treats of gear-tooth cutting, gear grinding, gear shaving, and gear casting and forming. The last three chapters are entitled, Design of Tools to Make Gear Teeth; Kinds and Causes of Gear Failures; and Special Design Problems.

GRAPHICS IN ENGINEERING AND SCIENCE. By Alexander S. Levens. 696 pages, 6 3/4 by 9 3/4 inches. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. Price, $7.

The principal objective of this book is to promote the use of graphics as a language, the premise being that a well-trained engineer or scientist should be proficient in the use of the languages of his profession—the language itself; the language of symbols, as used in mathematics, physics, and chemistry; and the pictorial language, graphics. The book is divided into three parts: (1) Fundamentals and Applications of Orthogonal Projection; (2) Technical Drawing Practices; and (3) Graphical Solutions and Computations. There are two work books available (priced at $4 each)—one to coincide with Part I of the text; and the other with Parts II and III.

FACTS ABOUT STAMPINGS. 32 pages, 5 1/2 by 8 1/2 inches. Published by the Pressed Metal Institute, Dept. FPR, 2860 E. 130th St., Cleveland 20, Ohio. Price, 50 cents (paper-bound) on company letterhead order.

This pamphlet has been compiled as an aid to those who are faced with problems in the designing and redesigning of parts for metal stamping production. Subjects covered are: holes, flanges, flanges and radii, layout, notches and slots, gage inspection, tolerances, steel gages, dimensions, press selection, definitions and suggested sales terms.

Three Films on Multipress Available

Three films, covering the operation of the Denison Multipress, are now available. The 16-millimeter, black and white sound films, showing the Multipress in operation in several leading plants, are:

"Multipress—and How You can Use It!," a thirty-minute film that discusses the Multipress and its operating characteristics in detail.

"Blanking and Forming," a ten-minute film showing on-the-job production scenes, and multiple-stage blanking and forming operations.

"Index to Profits," a twenty-minute film describing the use and design features of the Denison hydraulic index table, and showing a thirteen-Multipress production line.

Prints of the films can be obtained by writing to the Advertising Department, Denison Engineering Co., 1160 Dublin Road, Columbus, Ohio.

* * *

Die-Head Film Produced

"Facts about Die-Heads," a 16-millimeter sound and color motion picture, has been announced by the Geometric Tool Co. Division of the Greenfield Tap & Die Corporation, New Haven, Conn. This film, which runs twenty-four minutes, features self-opening dies and their operation. In addition, the subjects of solid adjustable die-heads and collapsible and solid adjustable taps are covered.

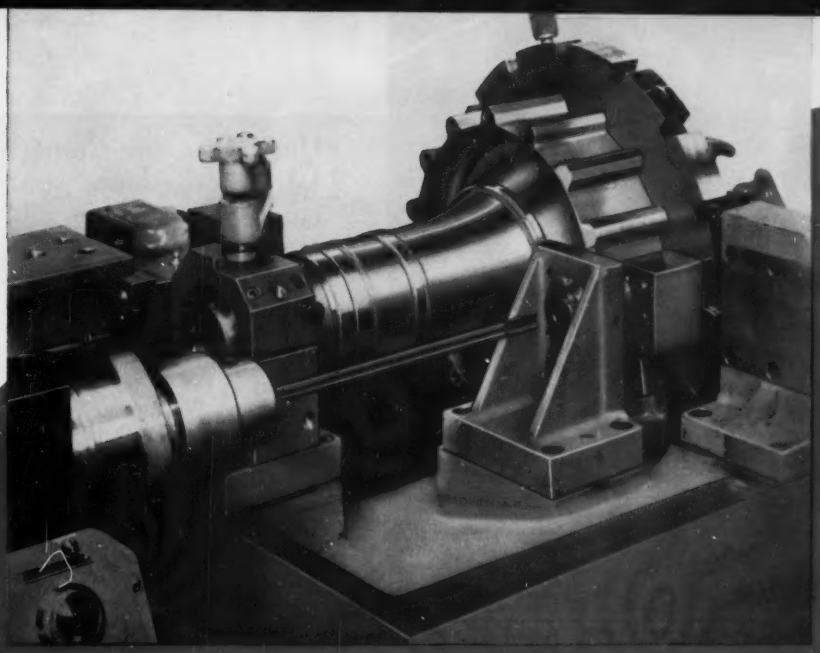
The film is primarily educational in character. Typical shots show the proper methods of installation, both hand and automatic operation, chaser insertion, and chaser sharpening. Featured are shots of a cutaway self-opening die-head and collapsible tap with the collapsible and resetting mechanisms in operation.

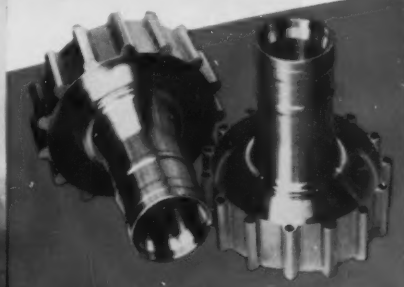
The film is available for immediate showing by Geometric field men who will supply projector and screen. Later, it will be available for general distribution.

* * *

Sheet Weight Calculator

A handy weight calculator for metal sheets has been devised by the Armco Steel Corporation. Weights can be determined for many types of special and commodity steel sheets, including coated and uncoated grades, as well as stainless-steel sheets and plates and the commonly used non-ferrous metals. On the reverse side of the calculator is a gage, weight, and thickness table for stainless-steel and hot- and cold-rolled mild-steel sheets, strip, and plates. The calculator is obtainable from the Marketing Service Dept., Armco Steel Corporation, Middletown, Ohio, enclosing 50 cents in coin.

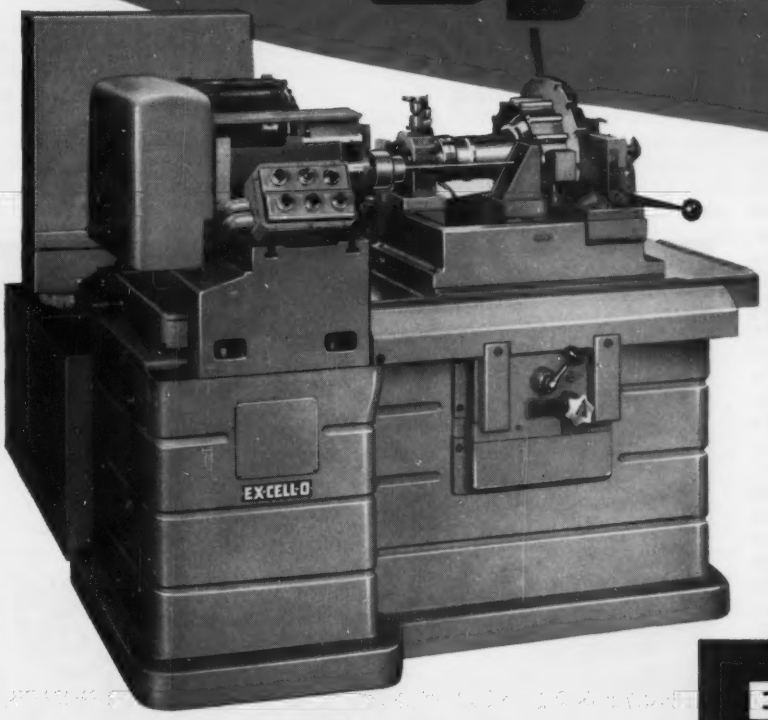




S.A.E. 4340 aircraft part before and after 15 Bor-Dril holes. Hole size and location are held within plus or minus .001".

The workpiece is clamped in an arbor having an index plate. Note the gun drill about to enter the guide bushing. Holes are ½" diameter, 3⅜" long.

EX-CELL-O ANNOUNCES BOR-DRIL



THE MODERN APPROACH WITH GUN-TYPE DRILLS

Ex-Cell-O Precision Machines are ideal for Bor-Dril machining of close-limit holes from the solid because of their smooth, easily-adjusted feeds and vibration-free construction.

EX-CELL-O CORPORATION
DETROIT 32, MICHIGAN

XLO

MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING SPINDLES • CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

54-46



Speed has been increased 50 per cent and feed doubled by changing to carbide triangular insert tool for interrupted facing of steel forgings.

Interrupted Cutting of Tough Steel Forgings

Interrupted cutting of tough, heat-treated S A E 4340 alloy steel forgings is currently being handled with over ten times longer tool life by the use of Kennamatic sintered tungsten-carbide, triangular insert tooling. This operation, performed at the Menasco Mfg. Co., Burbank, Calif., manufacturer of aircraft landing gears, consists of rough- and finish-facing both sides of a star-shaped forging.

The 11-inch diameter part is machined on a Warner & Swasey No. 2A turret lathe, as shown in the illustration. Heretofore, this job was performed with the work rotating at 87 R.P.M., a feed rate of 0.0035 inch per revolution, and a depth of cut of 0.030 to 0.095 inch. Even at this relatively low speed and feed, the best tool life obtained was only 2.4 pieces per grind.

Standard Kennemetal, Grade K5H, triangular insert tools are now used for the roughing cut with the work rotating at 101 R.P.M. (290 surface feet per minute). For the finishing cut, the work speed is 134 R.P.M. (385 surface feet per minute.) The feed rate has been raised to 0.0075 inch per revolution, twice that previously utilized.

Under these stepped-up operating conditions, nine pieces are machined before any indexing of the tool is required. Since three cutting edges are available on each end of the triangular insert, both sides of fifty-four pieces are faced before regrinding of the tungsten-carbide tool is necessary. Cimcool coolant is used in this operation.

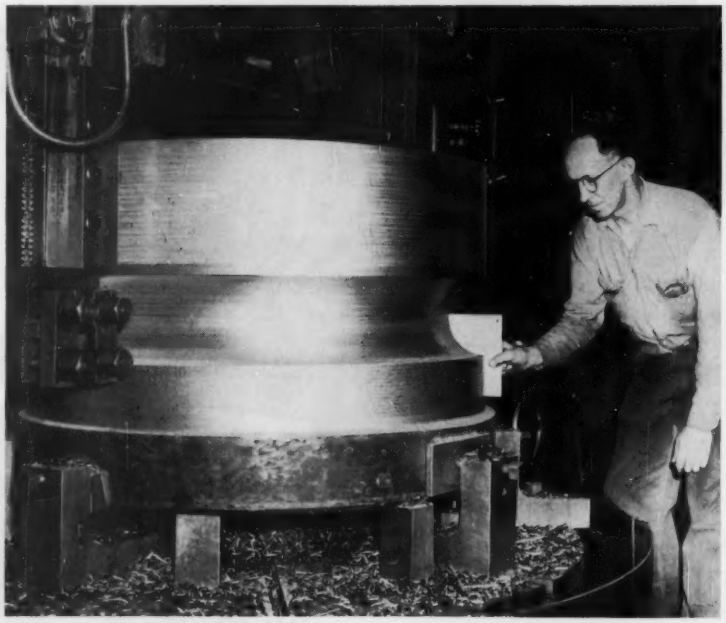
Changing time for the previously used tooling was 6.35 minutes. Time for indexing or rotating the triangular insert tool to a new cutting edge is only forty-five seconds. Regrinding of the previous tool required fifteen minutes. Now, both ends of the inserts are reconditioned in only ten minutes.

Huge Dies for Giant Tube Reducer

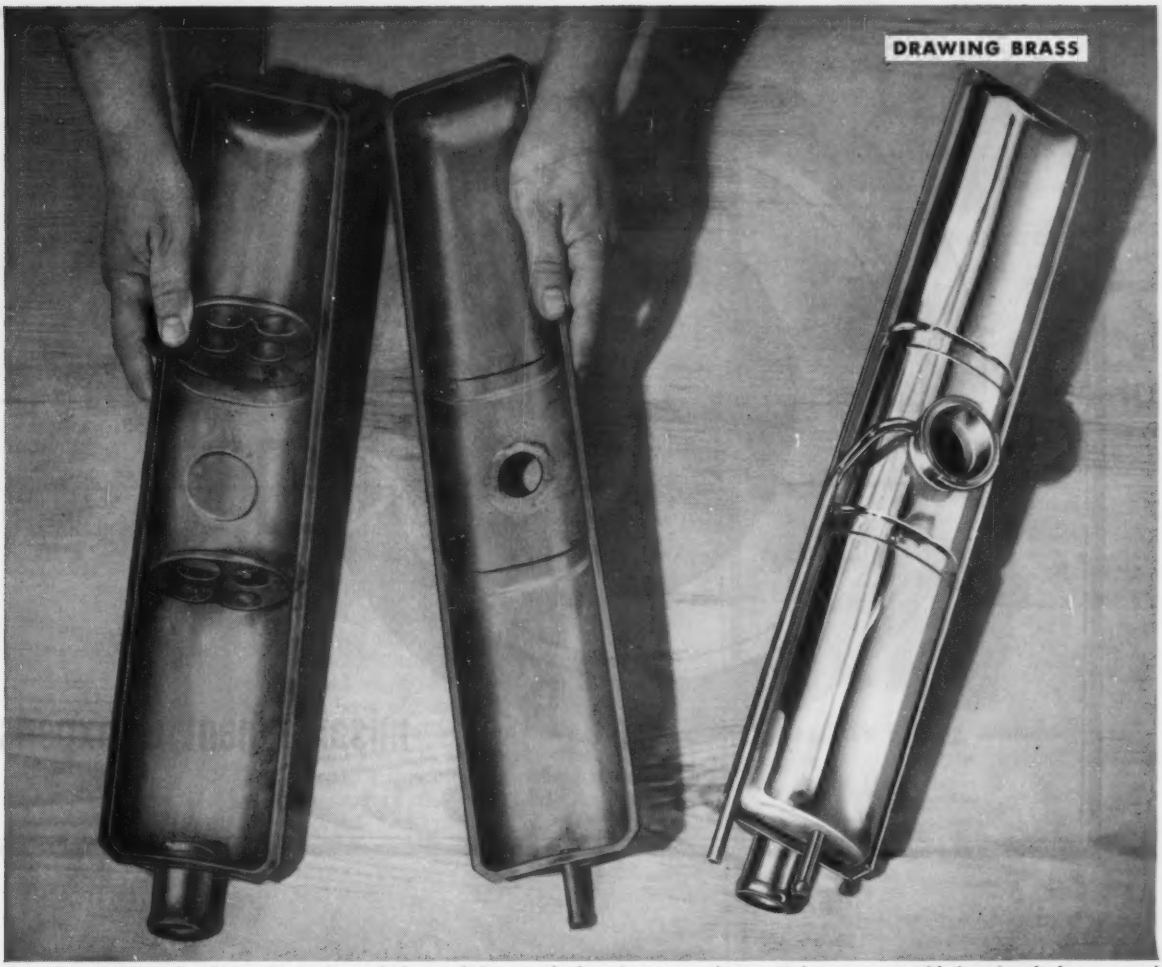
An 8400-pound die section, 50 inches in diameter, is shown in the illustration on a vertical boring mill at the Midvale Co., Philadelphia, Pa. The die will be used in a giant tube reducing machine which will be placed in operation at the Tube Reducing Corporation, Wallington, N. J. The new tube reducer is one of a pair of giant-sized machines that will make available for the first time cold-finished compression-formed tubing from 5 1/2 to 17 inches in diameter.

Processing of the die at the Midvale plant began with a chromium-molybdenum-steel ingot weighing 38,600 pounds. An upset disc was forged and rough-machined. Then the groove was rough-turned, and the die was split longitudinally into two sections and shipped to the Tube Reducing Corporation for final machining. The finished die has a 31-inch face width and a 50-inch diameter.

The die section shown is one part of a die unit as used in the compression forming process. A complete die unit consists of two of these sections inserted in heavy steel rolls 50 inches in diameter. Each roll with bearings will weigh approximately 60,000 pounds.



An 8400-pound die section, 50 inches in diameter, being machined for a giant tube reducing machine



RADIATOR TANK made of Formbrite shown before polishing and after chromium plating. Halves are assembled with a lock seam and soldered together with baffles inside. Intake spout, overflow tube and connecting fitting are also attached.

New fine-grain drawing brass cuts rejects from 13% to under 1%

These radiator tanks—used in a leading sports car—were first made of ordinary drawing brass.

But Morrison Steel Products Company, Buffalo, N. Y., found this brass wasn't stiff enough after forming. During handling, polishing and plating, many dents and nicks appeared on the surface. Rejects ran at about 13%.

Then Morrison turned to Formbrite* — Anaconda's new fine-grain drawing brass. Here's what happened.

1. Rejects dropped to less than 1%.
2. Appearance of the final plated tank (very important in a sports car) was so much improved that now Formbrite is specified for all these tanks.
3. Polishing costs were sliced almost in half.

WHY MORRISON FOUND FORMBRITE BETTER, CHEAPER TO USE

Formbrite has a superfine grain. Produced by special methods of rolling and annealing, this grain is *so fine* that often a simple color buff brings it to a bright, lustrous finish. (Compare magnification of Formbrite Drawing Brass with that of ordinary drawing brass. At right.)

Formbrite is harder, stiffer, springier and more scratch-resistant. It resists denting and deforming. Yet Formbrite is surprisingly ductile . . . readily stamped, formed, drawn and embossed. And Formbrite plates beautifully.

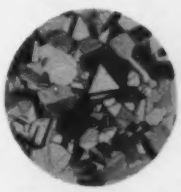
NO EXTRA COST

Premium price for this premium metal? Not at all. Formbrite costs not a penny more than ordinary drawing brass. It comes in sheets, strips and coils—in all commercial widths and gages.

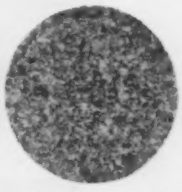
FREE SAMPLE

The way to find out about Formbrite is to try it yourself. Ask for a sample and more information. Just write to: *The American Brass Co., Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont.*

*Reg. U. S. Pat. Off. 8427



75x magnification of ordinary drawing brass.

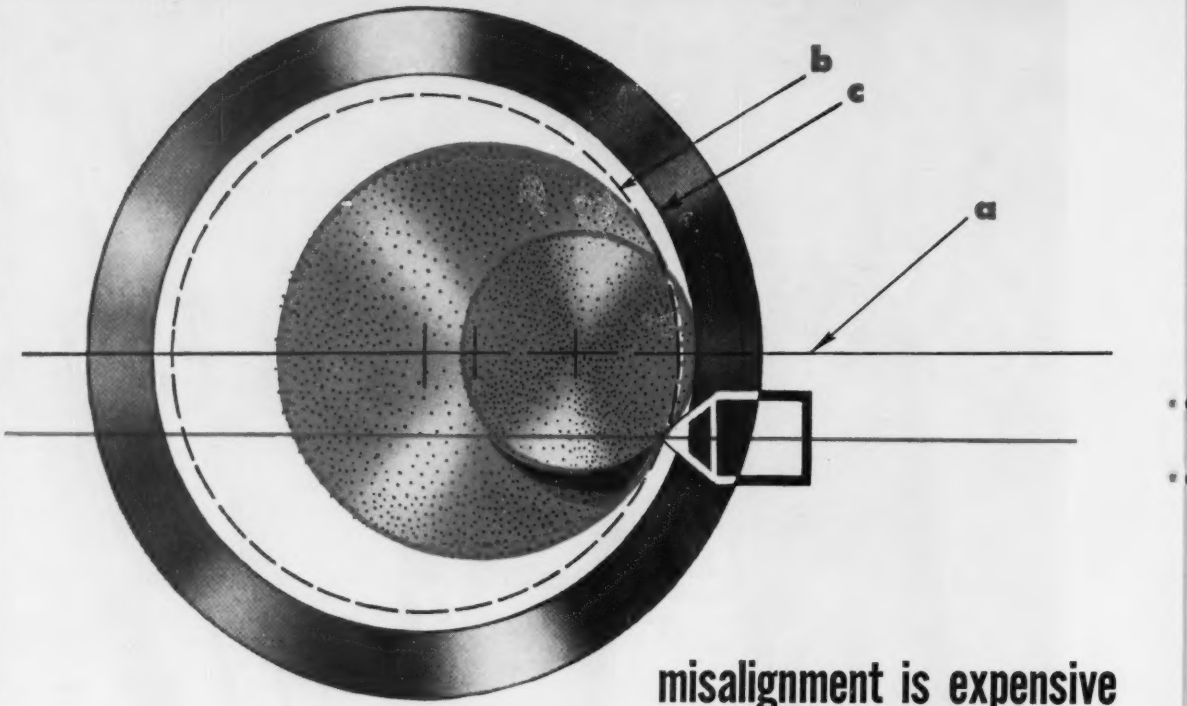


75x magnification of superfine-grain Formbrite.

Formbrite

FINE-GRAIN DRAWING BRASS
an ANACONDA® product

Made by
THE AMERICAN BRASS COMPANY



misalignment is expensive

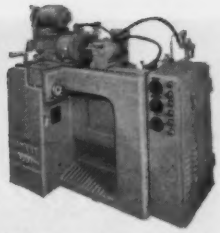
...Bryant controlled alignment

IF the internal grinder is to generate straight holes within precision tolerances, on a production basis, the various elements of the machine must be properly aligned. The axis of the work, the axis of the wheel and the diamond must lie in a plane parallel with both traverse and cross feed ways. Then the direction of feed will coincide with a line from the center of the workpiece to the point of contact between the wheel and the work. In addition, the wheel will be dressed in line with its point of contact with the work regardless of the size of the wheel.

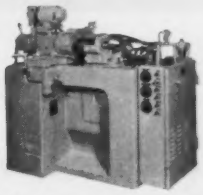
In the illustration above, these requirements are not met because the diamond is below plane "a" which is established by the work center line and wheel center line. The drawing shows the grinding wheel at its largest diameter (new) and also at its smallest diameter (worn). The center lines of wheel and work remain in plane for the life of the wheel and the position of the diamond remains constant for the life of the wheel. When diamond sizing, the work, or wheel, is fed to a series of predetermined positions,



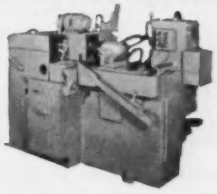
Write for "Alignment" booklet which gives complete details on this interesting subject. Also ask for booking form on new sound, color movie—free showings arranged for engineering groups.



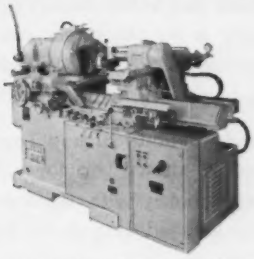
no. 1109 9" swing, semi-automatic



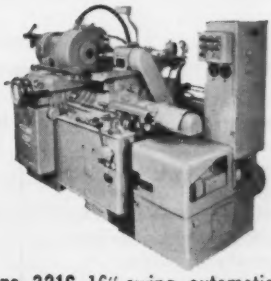
no. 1309-W 9" swing, 2 spindle semi-automatic



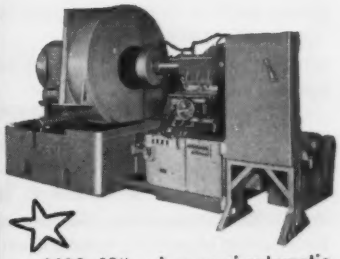
no. 2209 9" swing, automatic



no. 1116 16" swing, semi-automatic



no. 3216 16" swing, automatic



no. 1460 60" swing, semi-automatic

The Bryant 1460 Hydraulic Internal Grinder is designed to handle a variety of large work pieces such as bearing races, connecting rods, dies, up to 60" in diameter. Outside diameters and faces may also be ground. This semi-automatic machine will grind straight and tapered holes to a maximum depth of 16". The workhead can be swiveled to grind tapers up to 60° included angle using the full 60" swing or at any desired angle beyond 60° included angle at slightly less than 60". The bore of the work spindle is 9" in diameter to allow long work pieces to extend through the work spindle if required. Adjustment is provided under the rear of the wheelslide to insure straight line motion of the wheel. Write for folder.

gives better internal grinding

advancing a fixed amount from one workpiece to the next to compensate for wheel wear. As the wheel wears down it will continue to contact the work in plane "a". However, because the diamond is below plane "a", which is also the direction of feed, the new wheel contacts the work slightly beyond the diamond and generates hole "b". As the wheel wears down, the contact point with the work advances further beyond the diamond until hole "c" is generated. In short, the hole finished by the new wheel will be one size, but the worn wheel will remove too much stock and the hole will be oversize.

This is one of the reasons that some internal grinders, when set up for diamond sizing, will not hold size during the life of the wheel. In diamond sizing, uniform holes can be produced only by careful setting of the work center, wheel center and diamond in one plane (plane "a"), which must be parallel with both traverse and cross feed ways. Finish size will then be correct regardless of wheel diameter.

see our catalog in MACHINE TOOL CATALOGS or write for copy

Bryant Chucking Grinder Co.

Springfield, Vermont, U. S. A.

Internal Grinders • Boring Machines • Internal & External Thread Gages • Granite Surface Plates

Announcing the Moore-Fosdick

The only machine of its kind in

• Greater range—22″ x 42″ x 27″ height • Automatically positions work to ±.0001″

• Grinds jigs, dies, punches, templates and machine parts • Infinite Grinding Speeds—12,000 to 60,000 rpm • Contour and Chop Grinding • Slot Grinding Attachment • Spindle-Housing Heat Control

This new machine combines the unique Moore Jig Grinding Head with the exclusive Fosdick Automatic Positioning Table. It gives you greater capacity for precision grinding with the speed and convenience of a table that automatically positions work to ± .0001″. *There is no other machine in the world that even approaches the Moore-Fosdick in jig-grinding capacity, versatility, convenience and precision!*

Grinds Cylindrical and Tapered Holes. The Moore-Fosdick allows you to grind cylindrical as well as conical holes, with taper in either direction. An angular and indexing device built into the main spindle, and the newly developed slot grinding attachment, permit the quick, accurate grinding of any contour—*regular* or *irregular.*

Large Work Capacity—Infinite Number of Speeds. The Moore-Fosdick A. P. Jig Grinder has an infinite range of grinding speeds – from 12,000 to 60,000 rpm . . . allowing extreme versatility and accurate control of grinding and stock removal. Larger table size and greater work height, coupled with greater power, *extend* the overall range of precision grinding operations.

S P E C I F I C A T I O N S

Capacity:	No. 30-G	No. 42-G & No. 42-PG*
Table size	36″x18″	44″x22″
Table travel, Longitudinal	30″	42″
Table travel, Crosswise	17½″	22″
Table top to wheel collet	2″ to 27″	2″ to 27″
Spindle to column ways	18½″	18½″
Spindle to column below ways	20″	25¼″

Four spindle speeds: 90, 120, 180, 240

Spindle feeds by air-powered hydraulic control—infinite speed control

Grinding speeds: 12,000 to 60,000 rpm; 3 heads

Grinding Capacity:
With grinding wheels, 3/16″ to 5″ (8″ with adapter)
With diamond mandrels 1/64″ to 3/16″

Travel main spindle slide... 3⅜″

Angular adjustment of spindle up to 1½° either way or 3° included angle.

Radial offset of grinding spindle-from center to 1⅛″ off center by rough adjustment-while running 0.0001″ adjustment for distance of 0.075″ anywhere in the 1⅛″ range.

Weights and Floor Space:	No. 30-G	No. 42-G & No. 42-PG
Machine with regular equipment, including motor	6000 lbs.	11,000 lbs.
Shipping weight	6750 lbs.	12,000 lbs.
Floor space	77″x82″	102″x128″

Standard Equipment:
Four-speed constant torque ¼ hp motor, 220-440 volts, 50-60 cycles, 2-3 phase, wheel dresser—micrometer stop-wrenches. Two built-in locating devices: two 1″ .0001 inside micrometers; two 1″, 2″, 3″, 4″, 5″, 10″ and one 15″ end measurers in box.

Compressed Air Requirements:
90 to 100 lbs. @ 15 cfm, furnished by customer. We recommend a heavy-duty 7.5 hp air compressor with a water aftercooler, provided it is capable of this output.

*42-PG Moore-Fosdick Jig Grinder with Automatic Positioning.

Write today
for price and delivery information.

Jig Grinder

the world!



Positions Work Automatically to ± .0001". With the Automatic Positioning Table, you can get fast and accurate positioning of parts to be ground. Two simple duplicating bars may be prepared to position work automatically to ± .0001" – at the touch of a pushbutton. This means that complex grinding jobs with hundreds of holes require only one set-up. On "one-time" jobs, measuring rods can be used in place of bars. For precision production jobs, the easily-made, easily-stored duplicating bars give you a permanent record of positions. Once a job is run, you store the bars and use them every time you rerun that same job – weeks, months or years later.

Grinder Head Dimensional Stability. Latest design of the grinding head incorporates new features to improve further its stability. These include: (1) Electric heating elements in the main spindle housing to maintain uniform temperature whether machine is running or not; (2) An observation thermometer so located as to indicate any temperature change within the housing; (3) The housing itself is cast from 36% nickel iron to reduce the effect of any possible temperature variation to an irreducible minimum.

Need Drilling Equipment? Get a Proposal from Fosdick!



FOSDICK

THE FOSDICK MACHINE TOOL CO., CINCINNATI 23, OHIO





● Much more than mere salesmen, Standard's lubrication engineers are "Johnny-on-the-spot" when it comes to checking performance, offering advice on new products and otherwise being helpful. Here is J. E. Meyer, Jr. at work in the Trane Company plant. *You* can have advice and service like this. Call your nearby Standard Oil office or write: Standard Oil Company, 910 S. Michigan, Chicago 80, Ill.

the thread of this story depends on...

SUPERLA
REG. U. S. PAT. OFF.
Soluble Oil

● The coils manufactured by the world-famous Trane Company in La Crosse, Wisconsin are the heart of the heating and cooling equipment manufactured by this company. Threaded cast iron headers are used in many of these coils. The job requires cleanly threaded, cleanly finished holes that must be absolutely rust-free to assure maximum trouble-free operation.

Up to 1936, various soluble oils had been tried but none was successful in eliminating work spoilage due to rusting. On the advice of a Standard Oil lubrication specialist a switch to SUPERLA Soluble Oil was made with marked success.

Rejections due to rusting threads have been completely eliminated. At the same time, the quality of the threads has been excellent. In addition working conditions have also been greatly improved—with SUPERLA on the job, there's been no odor development, no gumming up of machines.

SUPERLA Soluble Oil can help you find a happy solution to your lubrication problem. SUPERLA forms stable emulsions . . . helps provide good finish and tool life and has superior rust prevention properties. Call your Standard lubrication specialist today and find out how he can help you.

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STANDARD OIL COMPANY
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60 tractor crankshafts per hour with

Avey 12 STATION LINE-O-DEX



12 Station Transfer Machine—Hydraulically operated indexing mechanism—operations include drilling all angular oil holes plus connecting metering holes. Machine incorporates all Avey-draulic Torque-matic Units for Deep Hole Drilling with Avey Cam Units and Drill Heads for Meter Hole Drilling. Machine conforms to J.I.C. Standards.



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Avey

for drilling... tapping... production machines

THE AVEY DRILLING MACHINE CO.

Cincinnati 1, Ohio

For more information on products advertised, use Inquiry Card, page 243



Hind-side as sandy as fore-side

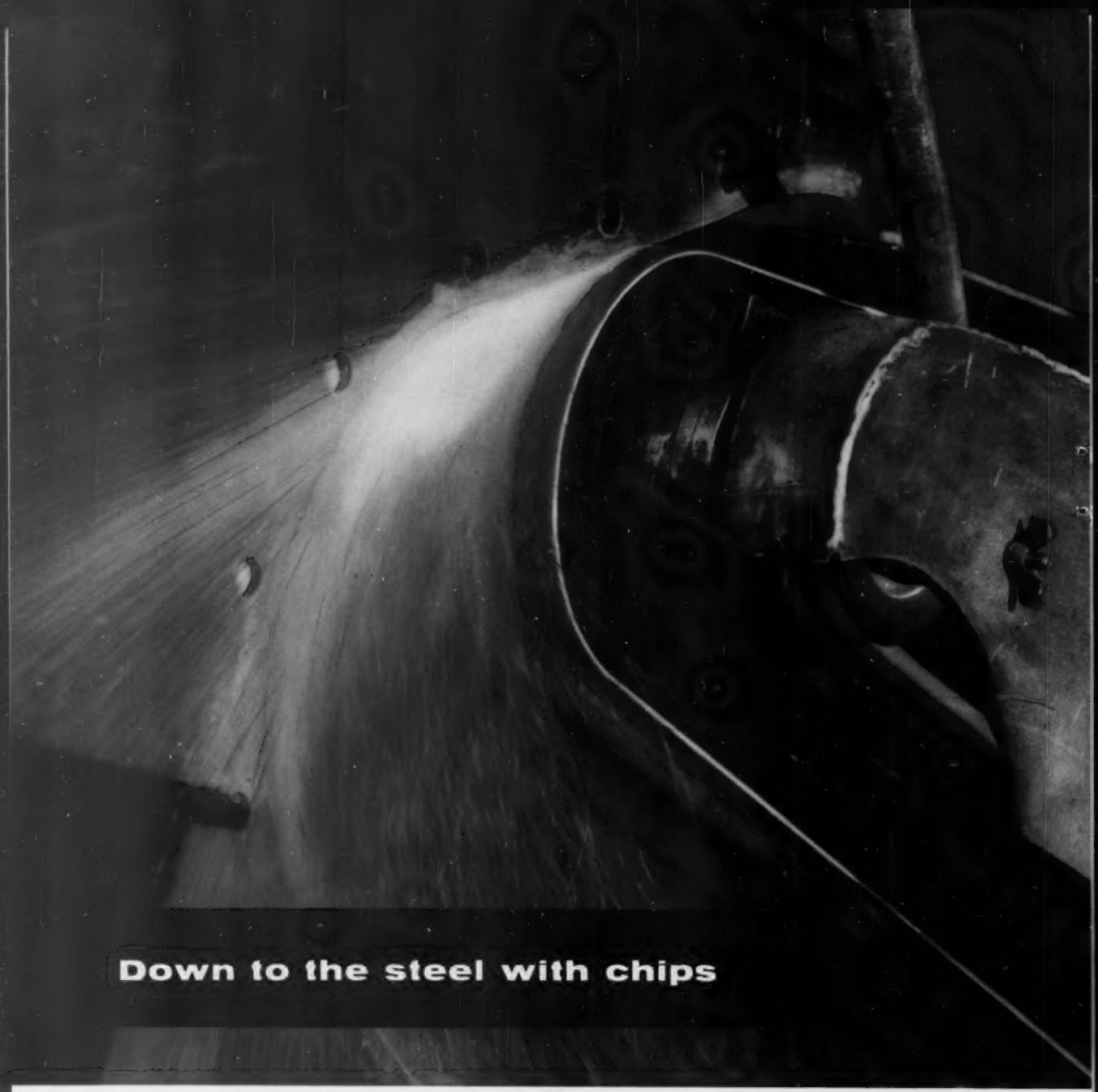
Use *both* sides of SAND SCREEN for sanding and finishing...do from 7 to 15 times more work with one sheet or disc than you can with conventional coated abrasives. Removed material flows through the open mesh—you sand faster, longer, with much less loading. Use SAND SCREEN wet or dry...for hand or machine finishing. Fold it—tear it to any convenient size. CARBORUNDUM'S SAND SCREEN Discs and FASTCUT Pad 85 Assembly slash time and costs on wet sanding of prime coats. On many operations of sanding flats and slight contours, no adhesives are necessary. Cut sheets fit oscillating or vibrating sanders... do a terrific job wherever loading and glazing is a problem. Get samples today from your CARBORUNDUM Distributor or Salesman.

Through product quality and application "know-how"

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continually puts more sense in your abrasive dollar



Down to the steel with chips

A glance at the spark flow tells you this CARBORUNDUM® Brand Abrasive Belt removes huge amounts of stock . . . fast. But that's not all—it also produces uniform finish, eliminates extra operations. The versatility and economy demonstrated by this swing frame belt grinder is yours to command on *any* metalworking operation, from deburring and polishing to weld grinding and snagging, with Abrasive Belts by CARBORUNDUM. They cut fast, cool . . . give smooth, even finish . . . long, useful life. Whether you use ½" belts on deburring machines, 74" belts on stainless steel sheet polishers—or any size between—your CARBORUNDUM Distributor is a good man to know. He offers expert counsel, complete stocks, prompt service.

Through application "know-how" and product quality

CARBORUNDUM

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continually puts more sense in your abrasive dollar

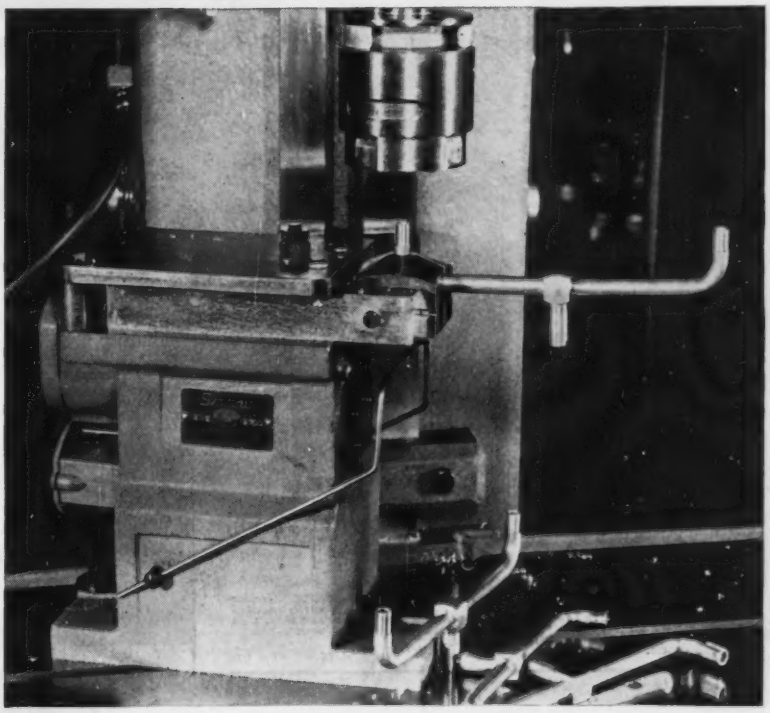
Quicker changeover, lower tooling costs...

with SNOW FULL UNIVERSAL MACHINES

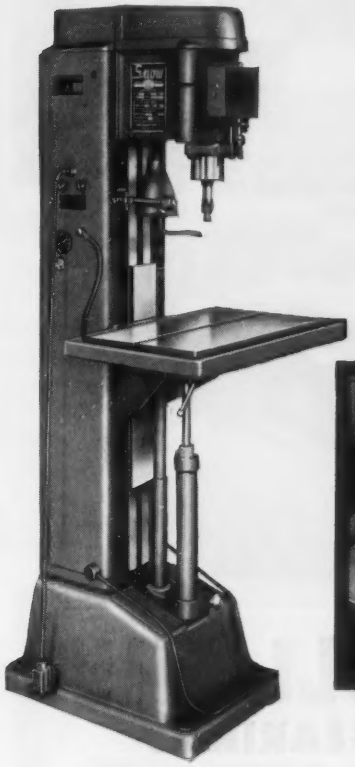
ELECTRICALLY OPERATED AIR CONTROLLED AUTOMATIC OR SEMI-AUTOMATIC

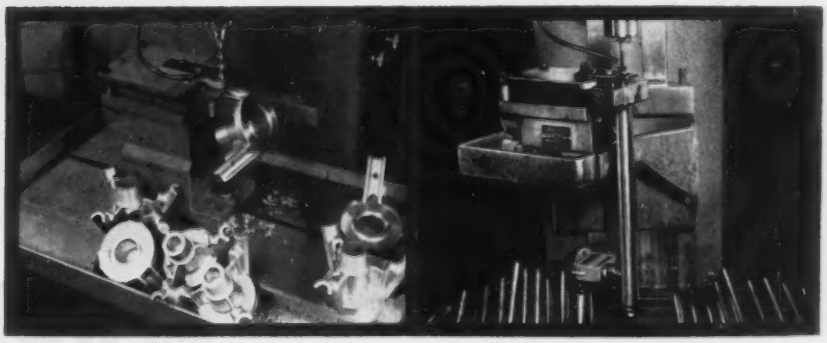
Basic Master Fixtures for DRILLING, THREADING or TAPPING. Snow universal machines are the most flexible, most efficient, and most economical known. They save countless dollars in changeover time — help you start jobs sooner — assure quality at high production rates.

The square footage under a Snow Machine in your factory can be the most profitable in your whole plant. Submit details of your requirements.



AIR VISE holds part firmly — self-centering — always in exact position for precision work. U-shaped wire underneath provides quick finger-tip control, automatically starting spindle cycle. Jaw inserts keep tooling costs at minimum. Blank jaws always in stock — can be tooled to fit your part promptly, inexpensively.





Irregularly shaped parts are easily handled. Front feed permits close setting of guide plate for greater accuracy with high production.

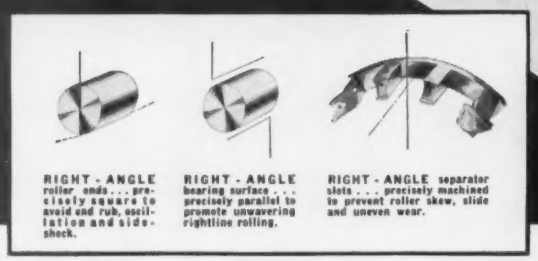
Here a short AIR VISE mounted on an offset table holds long tubing. Piece-part switch under table automatically closes vise and starts tapping operation.

SNOW MANUFACTURING CO., BELLWOOD, ILL.
(Suburb of Chicago)

UNWAVERING ORBITAL ROTATION



Because every surface is precisely square . . . precisely parallel. No skew . . . No skid . . . No oscillation



RIGHT-ANGLE roller ends . . . precisely square to avoid end rub, oscillation and side-shock.

RIGHT-ANGLE bearing surface . . . precisely parallel to promote unwavering rightline rolling.

RIGHT-ANGLE separator slots . . . precisely machined to prevent roller skew, slide and uneven wear.



ROLLWAY right-angle solid cylindrical roller bearings

Loaded at right angles, with no diagonal components to impose skew forces. Precisely square and parallel from every surface aspect. The solid cylindrical rollers of Rollway Right-Angle Roller Bearings follow the right-line motion of Newton's first law, providing *unwavering orbital rotation around the shaft.* Internal friction and heat are held to a minimum. Maintenance attention and replacement costs are low . . . life and load-performance qualities surprisingly high.

Our Complete engineering and metallurgical services will gladly work with you on your problems. Simply write or wire any sales office. No cost. No obligation.

Rollway Bearing replacements are available through Authorized Bearing Distributors in principal cities. Consult your classified 'phone directory. Rollway Bearing Co., Inc., Syracuse N. Y.

ROLLWAY BEARINGS

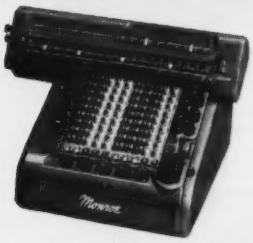
COMPLETE LINE OF RADIAL AND THRUST CYLINDRICAL ROLLER BEARINGS

SALES OFFICES: Syracuse • Chicago • Toronto • Cleveland • Seattle • Philadelphia • San Francisco • Boston • Detroit • Pittsburgh • Milwaukee • Houston • Los Angeles

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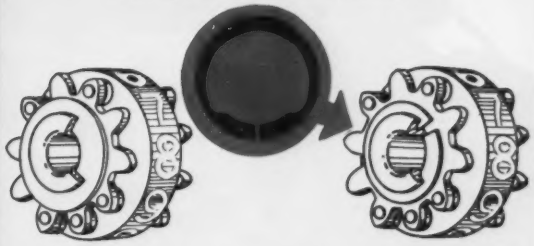
Waldes Truarc rings replace old-fashioned fasteners... save assembly time...end scrap loss...increase operating efficiency

This is the Monroe Calculator



...precision-engineered business machine made even more efficient, and less costly to manufacture through the use of Waldes Truarc Retaining Rings.

Multiplier Dial Assembly



Old Way. One-piece assembly was spun together. Spinning operation was costly, resulted in high scrap loss.

Truarc Way. Two-piece assembly is held together by one Truarc Ring (series 5108). Rejects: practically zero.

Electric Motor Governor



Old Way. Collector Disc assembly was formerly riveted, requiring skilled labor. Riveted Collector Disc could not be removed in the field.

Truarc Way. Truarc Ring (series 5100) replaces rivets, saves labor, material... improves Collector action. Collector Disc is easily replaced.

Intermediate Gear Shaft



Old Way. Washer riveted on end of assembly for zoning control. Costly, troublesome, hard to obtain critical zoning required.

Truarc Way. Truarc E-Ring (series 5133) cuts assembly time, virtually eliminates rejects and final assembly and zoning problems.

Monroe Calculating Machine Company, Orange, N. J. uses various types and sizes of Waldes Truarc Retaining Rings. Use of Truarc has helped eliminate scrap losses, saved on material and labor, and resulted in increased operating and servicing efficiency of the product. Monroe plans to use Truarc Rings for every possible fastening operation on their entire line!

You, too, can save money with Truarc Rings. Wherever you use machined shoulders, bolts, snap rings, cotter pins, there's a Waldes Truarc Retaining Ring designed to do a better, more economical job. Waldes Truarc Rings are precision-engineered...quick and easy to assemble and disassemble.

Find out what Waldes Truarc Retaining Rings can do for you. Send your blueprints to Waldes Truarc Engineers for individual attention, without obligation.



SEND FOR NEW CATALOG

WALDES

TRUARC

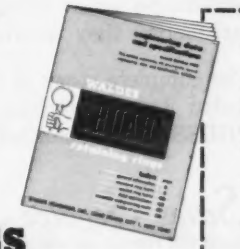
REG. U. S. PAT. OFF.

RETAINING RINGS

WALDES KOHINOOR, INC., LONG ISLAND CITY 1, NEW YORK

WALDES TRUARC RETAINING RINGS AND PLIERS ARE PROTECTED BY ONE OR MORE OF THE FOLLOWING U. S. PATENTS: 2,382,947; 2,382,949; 2,416,852; 2,420,921; 2,420,341; 2,439,705; 2,441,046; 2,455,165; 2,483,380; 2,483,383; 2,487,802; 2,487,803; 2,491,306; 2,509,081 AND OTHER PATENTS PENDING

For precision internal grooving and undercutting... Waldes Truarc Grooving Tool!



M096

Waldes Kohinoor, Inc., 47-16 Austel Pl., L. I. C. 1, N.Y.

Please send me the new Waldes Truarc Retaining Ring catalog.

(Please print)

Name .....

Title .....

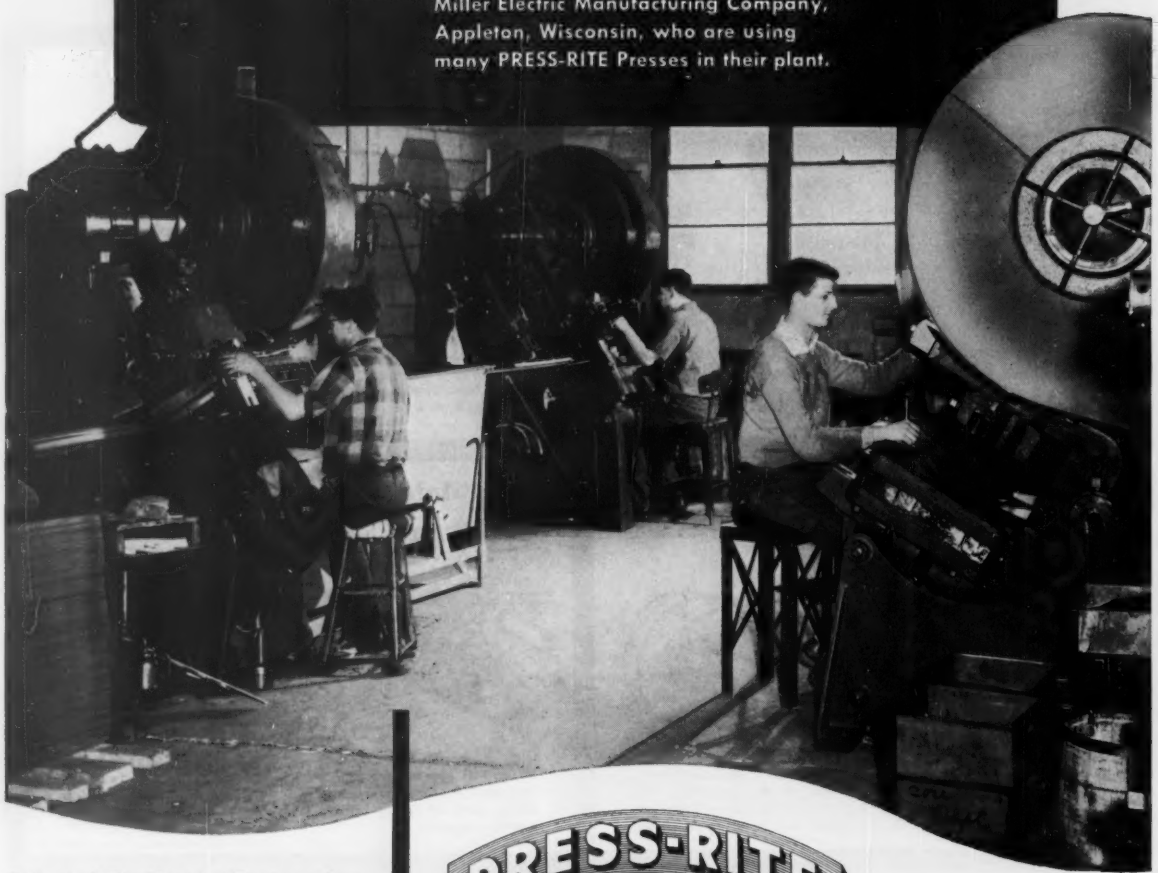
Company .....

Business Address .....

City ..... *Zone* ..... *State* .....

"We use our presses hard..."

writes: A. E. Harrant, Executive Vice President, Miller Electric Manufacturing Company, Appleton, Wisconsin, who are using many PRESS-RITE Presses in their plant.



"We, at Miller Electric Mfg. Co., ask an awful lot of our Press-Rite Presses, but we always seem to get a lot out of them.



As a leading manufacturer of arc welders and accessories, we produce laminations and various stampings, that come out accurate and true. Our insistence of high quality workmanship, plus the use of high quality material, makes it mandatory that we use quality equipment to produce quality products."

A. E. Harrant

PRESS-RITE

OPEN BACK—INCLINABLE

POWER PRESSES

. . . ruggedly built for production and service

Ruggedness for the toughest job . . . durability for long continuous service . . . precision built for accuracy and high production . . . all these are built into every one of the 8 PRESS-RITE Presses from 5 to 85 ton capacity. And, there are many other advantages which thousands of users acclaim as they tell of the satisfaction they receive from PRESS-RITE Presses.

The complete story of PRESS-RITE Presses is told in an illustrated 8 page brochure. Write for your copy today. See how PRESS-RITES can help you as they are helping others.

Sales Service Machine Tool Co. SSMT

PRESS RITE PRESSES • SHAPE RITE SHAPERS • KELLER POWER HACK SAWS

2351 UNIVERSITY AVENUE • ST. PAUL 14, MINNESOTA

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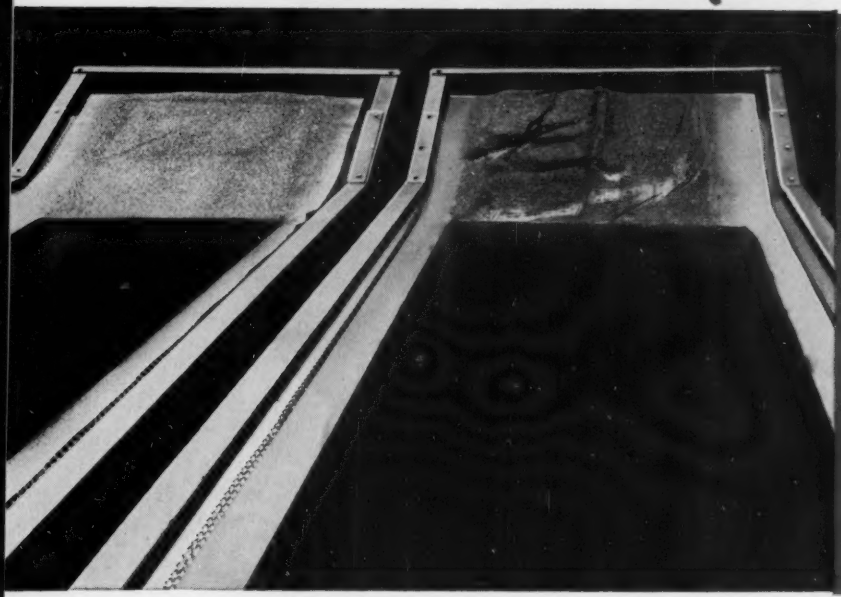
Delpark FILTRATION

AT

PRATT & WHITNEY AIRCRAFT

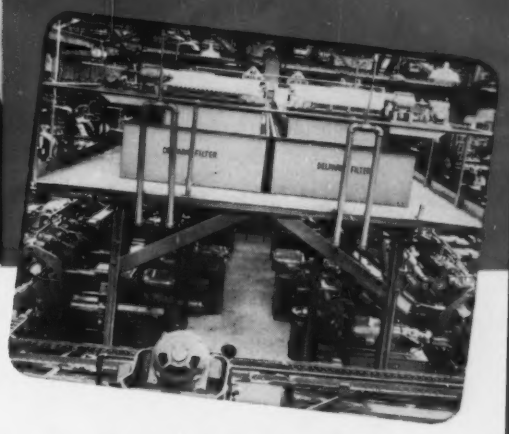
(DIVISION OF UNITED AIRCRAFT CORPORATION)

filters Aluminum Chips from Cutting Oil



Close up of DELPARK units filtering cutting oils from a battery of automatic Footburt Machines.

Illustration below shows same DELPARK installation in its position above the machines being served.



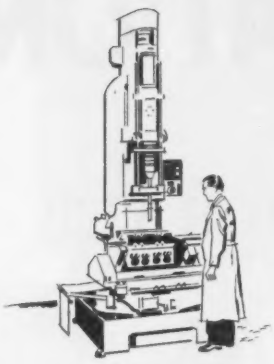
There are thousands of DELPARK Filters in industry today and the reasons for their acceptance are simple. The savings in maintenance labor alone is enormous yet other savings in reduced rejections, extended coolant and tool life and reduced machine parts replacements add up to even greater savings. Here is one part of production where costs can be materially reduced without retooling for design changes. Here, with DELPARK filtration, greater efficiency of men and machines can produce better products at less cost with greater accuracy.

It's a simple operation to let DELPARK filtration lower your operating costs and increase your profits. Let an experienced DELPARK filtration engineer give you the facts on DELPARK filtration. *Write for more complete information.*

Delpark INDUSTRIAL FILTRATION

Backed by More than 30 Years Experience in Industrial Filtration

INDUSTRIAL FILTRATION COMPANY, 15 INDUSTRIAL AVENUE, LEBANON, INDIANA





"Threads tore when they tapped B-1117 steel pipe ...here's why"

During a recent visit to a large midwestern manufacturer of refrigeration and heat transfer equipment, Sinclair Industrial Representative R. L. Hart found the concern experiencing unusual difficulty in tapping a B-1117 steel pipe.

Oil not following tap

Mr. Hart reports, "The work was being done on a hand screw machine with competitive cutting fluid. Closer inspection showed that the oil *was not following the tap but was wiping off at the point of insertion*—leaving a rough, torn thread."

Needed lightness, lard and sulphur

Mr. Hart continues, "Basing my recommendation on previous experience, I suggested Sinclair AUTOKUT® C. This oil would be light enough to follow the tap—with enough lard and sulphur to perform the cutting job. The manufacturer agreed to switch. In two weeks time he reported *the trouble had completely vanished*—thread quality far exceeded his expectations."

Why not let a Sinclair Lubrication Engineer help solve *your* cutting oil problems. *There's no obligation.* Contact your local Sinclair Representative or write Sinclair Refining Company, 600 Fifth Avenue, New York 20, N. Y.

SINCLAIR LUBRICANTS

For more information on products advertised, use Inquiry Card, page 243

4th
E. M. T. E.
Milan
Hall 7 - Stand N. 7508 7611

INNOCENTI
Lic. CWB



FAFT
204 147,5 mm.

COMBINED MACHINE

Milling and Boring Machine FAFT 147,5 mm. equipped whith swivelling arm, turning head and rotary table for turning, milling and dividing, working as normal milling and boring machine with eclipsable arm, and as vertical turning and boring machine with arm in working position.

Power available in the milling cutter: 40 HP.

Automatic cycles, precision stops on all movements, including rotary table, through electric control.

Pendant box controlling all feeding or rotation movements, either simultaneous or separate, spindle speed selection, locking of carriage and table.

Possibility of equipping swivelling arm with vertical milling and boring headstock.

Spindle speed (stepless range): 1,3 to 640 rpm.

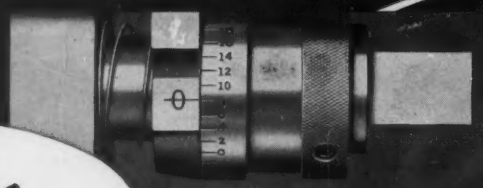
Weight: 100 tons.

INNOCENTI

SOC. GENERALE PER L'INDUSTRIA METALLURGICA E MECCANICA

MILAN — NEW YORK — PARIS

Information and literature from: Innocenti Corporation, 350 Fifth Avenue, New York 1, N.Y.



blade clearance indicator

. . . precise adjustment, easily and quickly made by the operator, gives correct blade clearance for any gauge or type of metal, minimizes burrs and greatly prolongs blade life.

another *Columbia* shear feature

Columbia "New Series" steel squaring shears have many features specifically designed and refined to give low-cost, trouble-free operation.

quick-set blade clearance adjustment

The Blade Clearance Indicator, for example, lets the operator adjust blade clearance quickly and easily. This feature eliminates waiting for supervisory personnel, gives burr-free shearing on any gauge metal and significantly increases blade life.

Other Columbia features you should know about include the exclusive air clutch, hydraulic hold-downs, jog control for ram and others. Combine these with basic rigidity, rugged mechanism and long-lasting accuracy and you have the answer to low-cost shearing . . . the Columbia "New Series" Shear.



Columbia
Steel Squaring Shear,
Model 0410, Capacity: 10′ x ¼″

Other exclusive Columbia features are explained in detail in ***FREE Bulletin No. PS-1. Write for it and the name of your Columbia distributor today!***

Columbia Division, The Lodge & Shipley Co.
Hamilton 1, Ohio

new-series *Columbia* STEEL SQUARING SHEARS and POWER PRESS BRAKES

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NEW

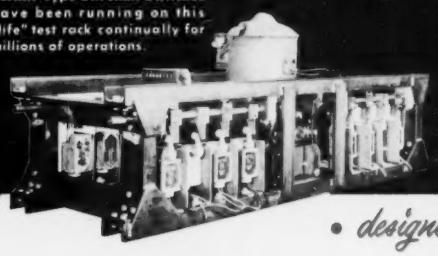
CLARK

Type DM

MACHINE LIMIT SWITCH



CLARK Type DM Limit Switches have been running on this "life" test rack continually for millions of operations.



• designed and built for dependability and longer life-

Our design engineers were given the assignment of developing a new heavy-duty machine limit switch to meet the exacting needs of modern industry. Primary requisites were dependability, accuracy, durability and versatility. They created a design that is rugged, simple and 100% functional. They selected materials for the working components that hold up indefinitely under the most severe punishment. They employed sound, mechanical principles to provide positive, accurate, trouble-free operation, and added features to make the switch as nearly "fail-safe" as possible.

Pilot models were subjected to severe breakdown tests, and changes made as indicated. When our high standards for performance and durability were finally met, the initial production run was made. The first production units were placed on the test rack illustrated, and have been operating continuously ever since.

THE CLARK CONTROLLER CO.

ENGINEERED ELECTRICAL CONTROL • 1146 EAST 152ND STREET, CLEVELAND 10, OHIO

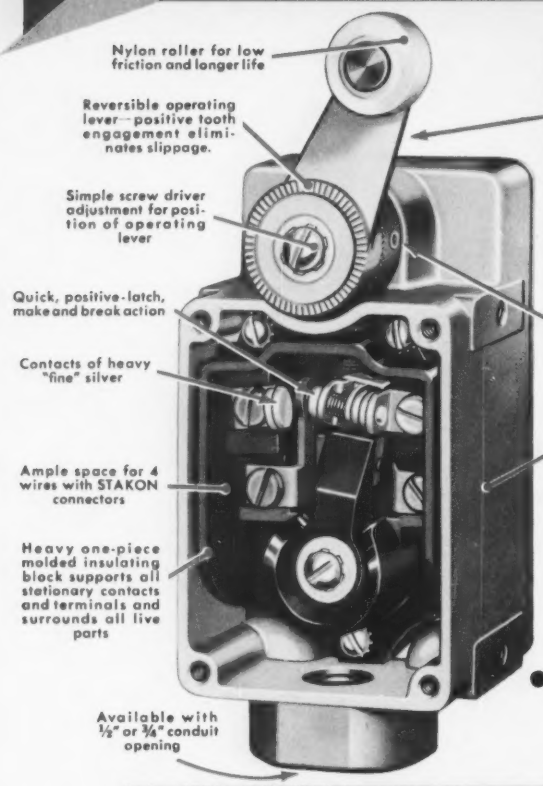
See other side for further details

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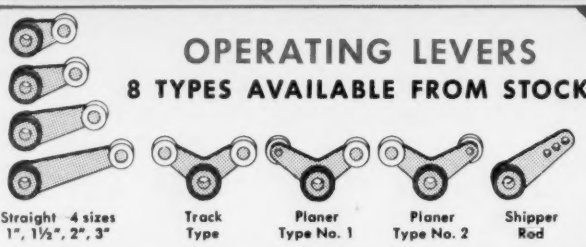
CLARK *Type DM* LIMIT SWITCH

built for RUGGED SERVICE

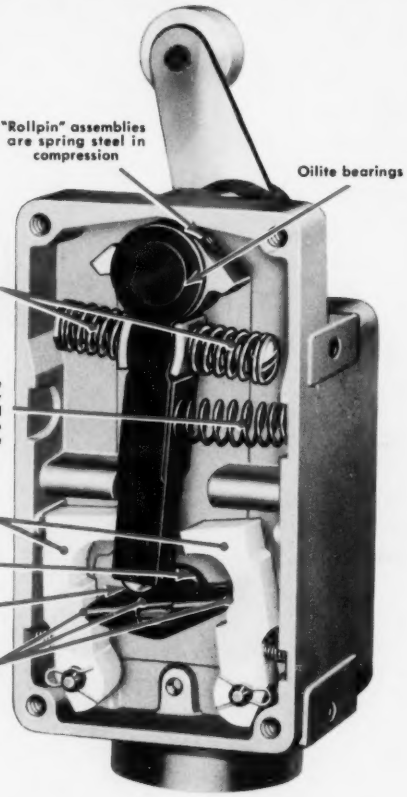
VERSATILITY • LONG LIFE • ACCURACY



OPERATING LEVERS
8 TYPES AVAILABLE FROM STOCK

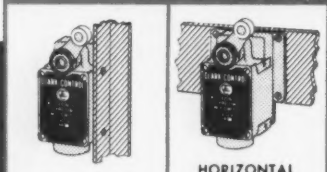


CLARK Type DM LIMIT SWITCHES are simply built, with a minimum number of parts. They are designed for one purpose: to provide dependable, accurate, trouble-free operation for a long life. All latch and trip-bearing surfaces are nylon to steel for minimum wear. All springs are in compression for greatest safety—they cannot be overloaded.

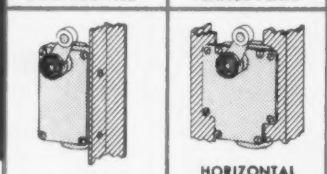


REGULAR AND REVERSE LEVER TYPES
—can be mounted in any position

REGULAR MOUNTING TYPES



REVERSE LEVER MOUNTING TYPES



Six styles of back covers or mounting plates are available for an infinite variety of mounting arrangements.

Insist on CLARK Type DM Limit Switches for more dependable, longer life operation on all your new machines and for replacement of unreliable or worn out switches on equipment now in use.

THE CLARK CONTROLLER COMPANY
1146 EAST 152nd STREET • CLEVELAND 10, OHIO

Please send me Bulletin 102 DM describing the new CLARK Type DM Limit Switch.

NAME_____

TYPE OF BUSINESS_____

COMPANY_____

ADDRESS_____

CITY AND STATE_____

Send for 4-page descriptive bulletin giving full specifications and ratings. Use this coupon.

ENGINEERED ELECTRICAL CONTROL • 1146 EAST 152ND STREET, CLEVELAND 10, OHIO

National Tool Co.





Years of successful experience in special tooling and related production problems are yours for the asking. When the job requires special cutting tools call in your National Tool Co. representative. He is backed by more than 49 years experience in the engineering and manufacture of special cutting tools. His assistance is yours, without obligation, whether you're interested in one tool or a complete tooling program.

National Tools Cleveland

National
TOOL CO.
Cleveland 2, Ohio

ADDRESS

CITY AND STATE

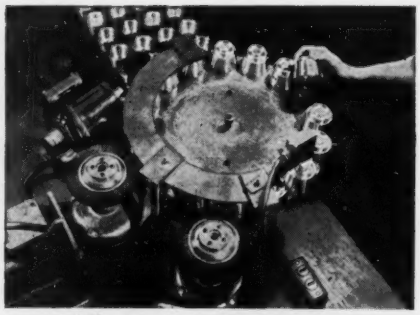


Cuts costs. Here, push-button brushing finishes both sides of brass discs at a rate of 15,000 per day Does a more uniform job many times faster than former hand method.

This study of *your* operations could save you thousands of dollars

Every day, Osborn Brushing Specialists make startling improvements in production jobs such as shown above. They do this by studying cleaning and finishing operations and making an **O**sborn **B**rushing **A**nalysis . . . a written report with recommendations on all jobs which can be improved with the latest push-button brushing techniques.

An **OBA** in *your* plant may save you thousands of dollars. It won't cost you a cent. Ask for an **OBA!** Call or write *The Osborn Manufacturing Company, Dept. D-21, 5401 Hamilton Avenue, Cleveland 14, Ohio.*



Saves 74%. A manufacturer of aluminum components is now removing burrs and blending surface junctures of parts at a rate of 1400 per hour, compared to 360 with former hand method.

Osborn Brushing Analysis

TO HELP YOU DISCOVER HIGHER QUALITY AND LOWER COSTS WITH POWER BRUSHING

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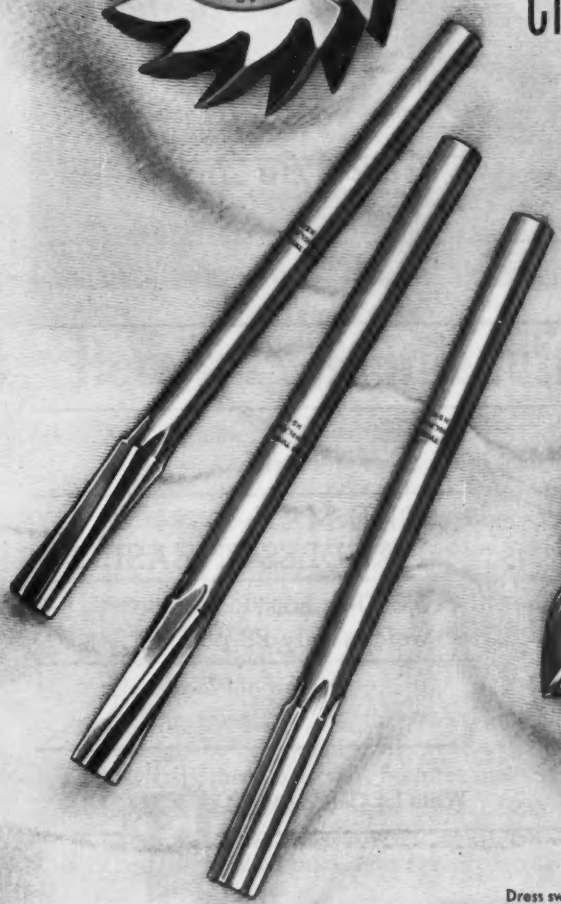
UNION



Craftsmanship...

Expertly fashioned by hand, this engraved, finely-balanced, ceremonial sword is our outstanding example of the armorer's art.

Today, outstanding in their field, Union cutting tools meet every demand of your most highly skilled workmen.





Dress sword carried by General H. K. Olliver of the Ancient and Honorable Artillery Company of Boston in 1845.

END MILLS

Spiral Cut
Two Lipped
Straight Shank
Taper Shank
Shell
Hollow
T Slot
Double End
Single End
Long
Small Diameter
Corner Rounding
Ball End

REAMERS

Hand
Jobbers
Carbide
Expansion
Center
Shell
Rose Chucking
Chucking
Taper Pin
Helical Flute
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Roughing
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TWIST DRILLS
CUTTERS
HOBS
METAL SLITTING SAWS
INSERTED BLADE CUTTERS
COUNTERSINKS
COUNTERBORES
CARBIDE TOOLS

UNION TWIST DRILL COMPANY • ATHOL, MASSACHUSETTS

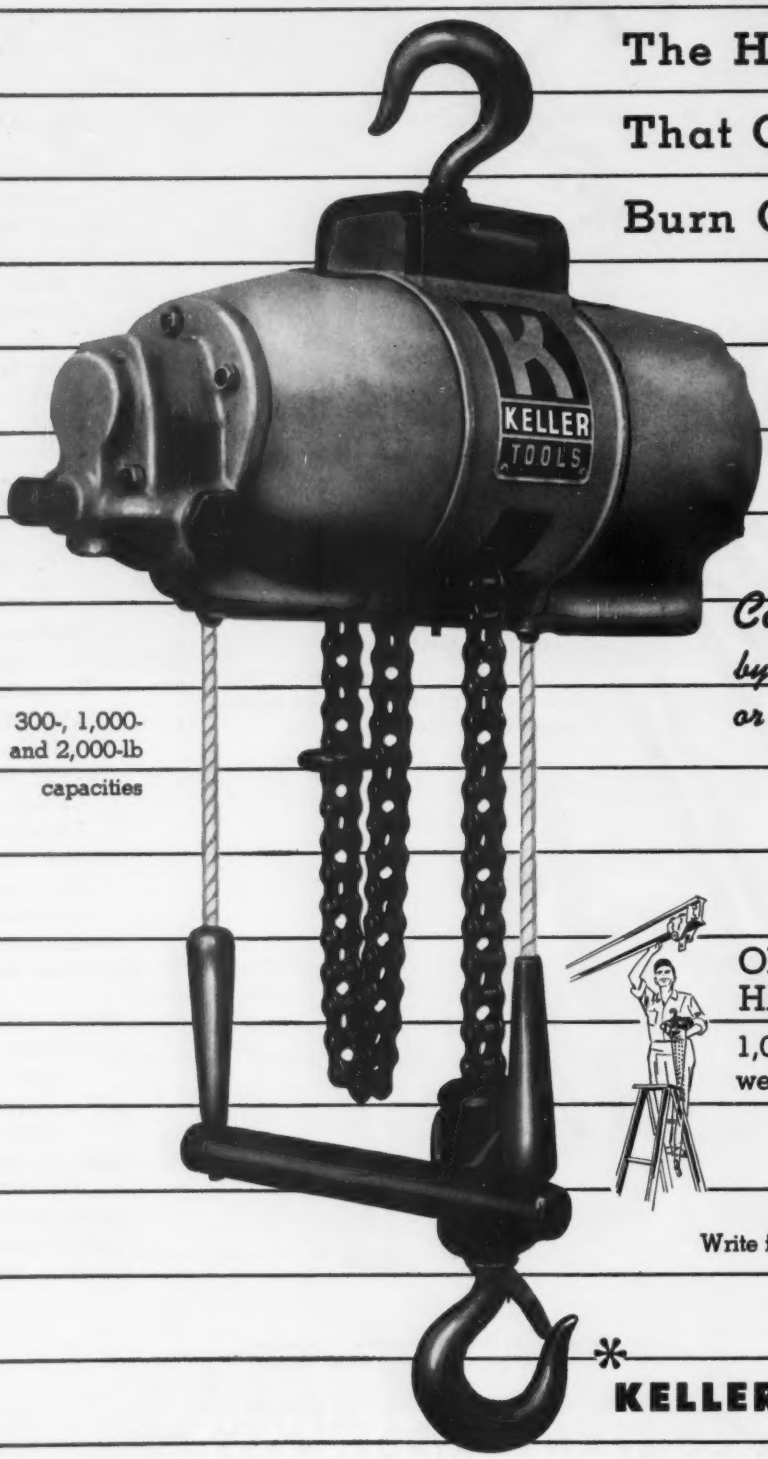
End Mills Milling Cutters Gear Cutters Twist Drills Hobs Reamers Carbide Tools

***OWNERS AND OPERATORS OF:* S. W. CARD MANUFACTURING CO. DIVISION, Mansfield, Mass.**
BUTTERFIELD DIVISION, Derby Line, Vermont and Rock Island, Quebec

CUT INVENTORY COSTS, ORDER FROM YOUR LOCAL DISTRIBUTOR

KELLER

The Hoist That Can't Burn Out !



Can't Overheat
from rapid reversals

Can't Be Damaged
by continuous service
or stalling under load

300-, 1,000- and 2,000-lb capacities

ONE MAN HANDLES IT EASILY

1,000-lb hoist weighs only 28 pounds

Write for Catalog 86



KELLER AIR HOISTS

KELLER TOOL COMPANY
1307 FULTON ST., GRAND HAVEN, MICH.

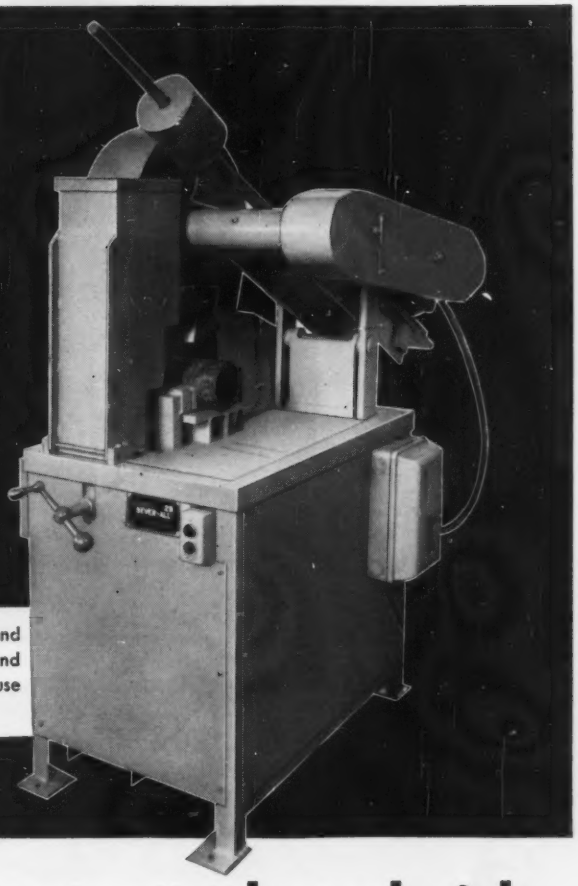
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an ACCO product

Campbell Abrasive Cutter

New Model 28 Campbell Sever-All Dry Cutter

- Compact
- Portable
- Ideal for contract or construction work



CAPACITY: Solids up to 4" x 4" square, angles and channels to 8", tubes and pipes to 4" O.D., 4" angles and channels and 4" O.D. pipe at 45° angles. Based on use of 18" cutting wheel and 10 H.P. motor.

Here's a versatile cutter you can take to the job

• This new CAMPBELL Model 28 SEVER-ALL Abrasive Cutter is a dry-cutting machine which combines the capacity for a wide variety of cutting operations with a compactness which permits a portability seldom found in cutters of its type and capacity. It is ideal for cutting all types of material in contract or construction work. Can be supplied with work stop and with wheels for easy movement from job to job.

From front to back, the SEVER-ALL measures but 56". It is only 32" wide and 62" in height. Other important features include:

1. Work clamped on both sides of cut by hand-operated, self-centering work holders. Can be supplied with foot-operated treadle.

2. Time of cut is approximately 3 seconds per square inch of material.

3. Operator safety provided by complete enclosure of cutting wheel during operation—except for openings to clear the work.

4. Lowering of guard permits accurate location of work, permits long pieces to be placed in machine without threading through.

This Model 28 SEVER-ALL cutter is the newest of a long line of CAMPBELL Abrasive Cutters which provide many exclusive features. CAMPBELL field engineers are conveniently located to consult with you on ALL your cutting problems. Write today for specifications on the SEVER-ALL or **Bulletin DH-301** on the CAMPBELL Abrasive Cutting Method.

ACCO

Campbell Machine Division
AMERICAN CHAIN & CABLE

925 Connecticut Avenue, Bridgeport 2, Connecticut

Wet and Dry Cutters and Nibblers



It's the wHOLE Truth.....



Machine tool men "in the know" have long acclaimed the "US" Adjustable Multiple Spindle Drill Heads with their quick-change universal joint assemblies. They are built for continuous use, with full anti-friction bearing construction for high capacity thrust loads. The universal joint adjustable multiple spindle type is suitable for any sensitive drilling machine. Joints are self-lubricating.

The single eccentric type is used for equally spaced holes on bolt circles.

The new double eccentric AdjUStafix, two to eight spindles, permits spindles to be located in non-symmetrical patterns. It eliminates expensive change in set-up.

Write for details on any type of universal joint adjustable head. Ask also about our totally enclosed gear-driven adjustable, fixed center, or individual lead screw tapping heads.

UNITED STATES DRILL HEAD CO., 616-618 Burns St., Cincinnati 4, Ohio

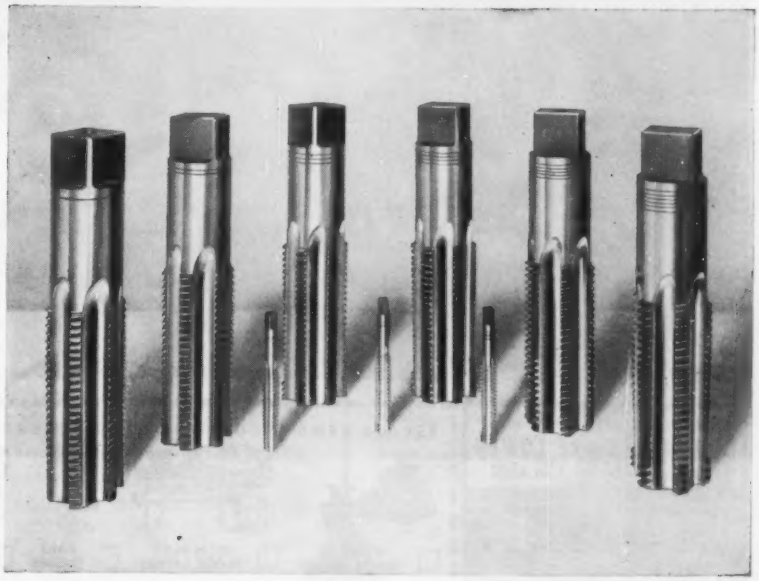
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SPECIAL TAPS?



Ability of a tap manufacturer is measured not so much by the success of a single sample, as by his ability to duplicate that tap on a production basis. At Detroit Tap & Tool we utilize a unique system that records every detail of every special tap manufactured.

Detroit Special Taps are Tops for a Good Reason...



This record system controls quality right from your first order. It is your guarantee that, having found the "right" tap for the job, you will get the same results with every additional tap you order.

Such records minimize the development of special taps. Often, the new problem is so similar to a previous one—already a matter of record—that a minimum of research and engineering is required for the new tap. The advantages of such service is obvious.

See your Detroit Tap & Tool Company representative today. Stocking distributors are located in major industrial areas.

DETROIT TAP & TOOL CO.

8615 E. EIGHT MILE RD., BASELINE, MICHIGAN

SOUTH BEND VALUE PAYS OFF IN ACCURACY AND PRODUCTIVITY



It's the value built into South Bend Lathes that adds the extra precision, adaptability and dependability that makes them so popular. This also brings to metal working operations an accuracy and productivity that means better products at lower costs.

South Bend Lathes have been doing this for years and years. They have been the choice of cost-conscious management for their efficiency and low up-keep. Machinists like them for their easy operation and ability to hold tolerances.

Take advantage of South Bend features and get lower machining costs as countless others have. Let our nearby distributor help you do this by showing you how you can best use South Bend Lathes.

Illustrated: 16" x 6' Quick Change Gear Lathe. Price $2151 f.o.b. factory, less electrical equipment, chuck and taper attachment. Time payment terms $216 down and $114 monthly for 18 months.

New Catalog

Describes 9" to 16-24" Lathes, ½" and 1" collet Turret Lathes, 14" Drill Presses, 7" Bench Shapers and Pedestal Grinders. Ask for new Catalog 5406.



Compared with our costs
OUR PRICES ARE LOWER
than they were back in 1941



Prices are closely tied to costs. Costs are still rising. Buy now before increased costs necessitate higher prices.

PLEASE SEND INFORMATION CHECKED:



☐ 9" and 10" BENCH LATHES



☐ 10" to 16-24" FLOOR LATHES



☐ DRILL PRESSES



☐ ½" & 1" Collet TURRET LATHES



☐ TOOL GRINDERS



☐ 7" BENCH SHAPERS

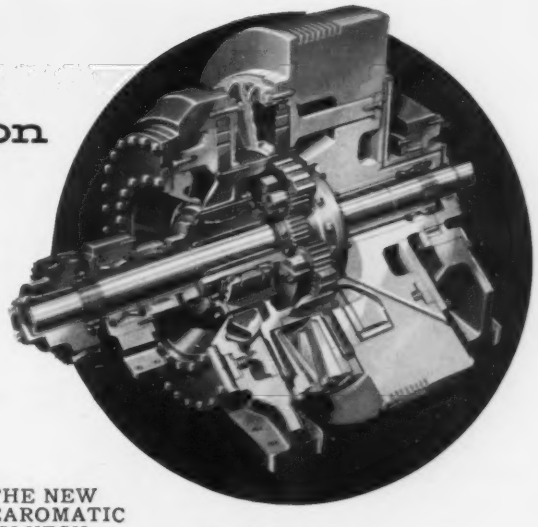
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City_____ State_____

Building Better Tools Since 1906 • SOUTH BEND LATHE • South Bend 22, Indiana

For more information on products advertised, use Inquiry Card, page 243

clearomatic can DOUBLE your production of drawn parts



The new Clearomatic press clutch, shown in the cutaway illustration at right, is the key to the productive efficiency of the Clearomatic press. It doesn't just speed up production, it *doubles* production as compared to conventional draw press operation. You get twice the number of cycles per minute—twice the number of drawn parts, but slide speed during the effective draw — that part of the stroke where the work is done — is actually slower than on conventional presses.

THE NEW CLEAROMATIC CLUTCH



call on C.P.C. *

Here is a specific example of the way *Clearing Productivity Consultants can help you push your manufacturing capacity far beyond what was once considered its natural limits. The new Clearomatic press is a proven fact. It has demonstrated its ability to double production in actual shop runs.

There are Clearing consultants in every field of press metalworking, ready to combine their experience with yours to help bring about greater returns in your manufacturing operation. Why not call on Clearing Machine Corporation today?

HOW IT WORKS

New bulletin on the Clearomatic press tells what it can do for you and how it operates. Your copy will be mailed without obligation.



CLEARING PRESSES THE WAY TO EFFICIENT MASS PRODUCTION

CLEARING MACHINE CORPORATION · 6497 West 65th Street Chicago 38, Illinois · HAMILTON DIVISION Hamilton, Ohio

Another Duplex Milling Machine

BY MOTCH & MERRYWEATHER

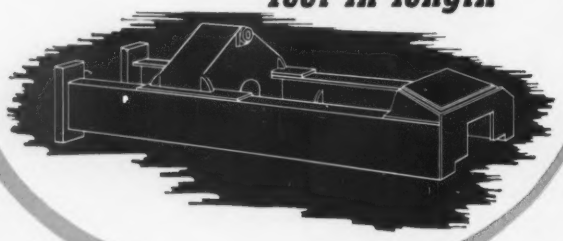
Fifty Years 1904 • 1954

STANDARDIZED TRAVELING HEAD DESIGN is adapted to *Many Specialized Jobs*



A Motch & Merryweather Duplex Milling Machine finishes the pads of an 8-foot tractor frame. A second frame (rear) is loaded while the first frame (front) is milled.

... especially for Large Parts 6 feet to 11 feet in length



Again using the facility of *traveling milling heads* instead of traveling fixtures, Motch & Merryweather creates greater universality, saves time, original cost and floor space. Standardized design enables duplex operation to dispatch a wide range of work with money-making speed and accuracy. Simplified fixturing is readily adjustable to handle parts of varying size. May we study your requirements?

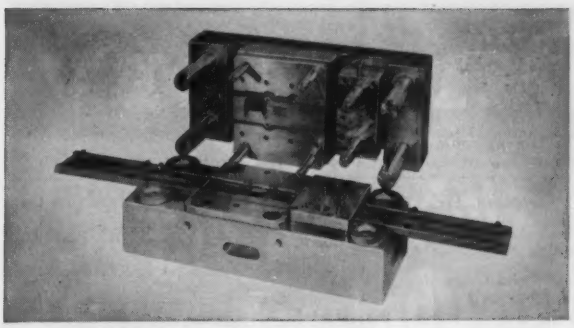
THE MOTCH & MERRYWEATHER MACHINERY CO.

MACHINERY MANUFACTURING DIVISION

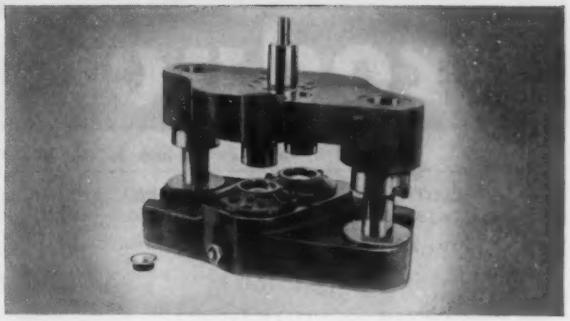
CLEVELAND 13, OHIO

Builders of Circular Sawing Equipment, also Production Milling, Turning, and Special Machines

For more information on products advertised, use Inquiry Card, page 243

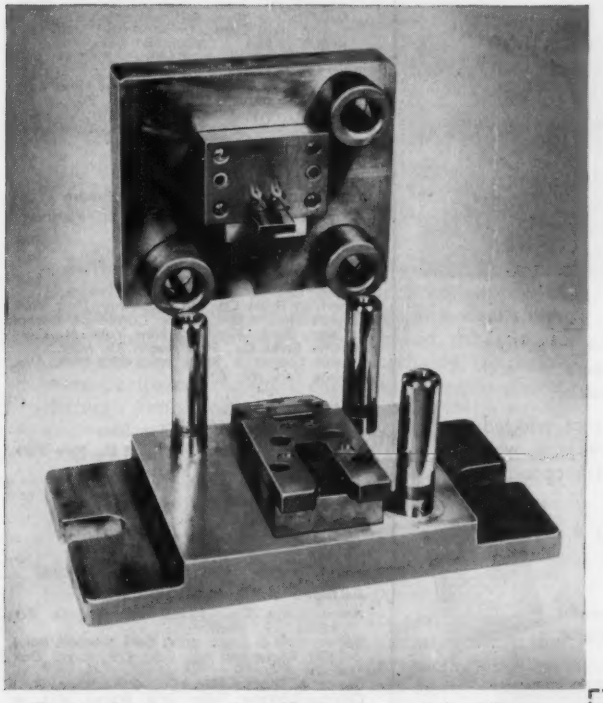


1 Lamination die, made for Schick, Inc., produces rotor and stator laminations of motor-grade silicon steel. Customer reports carbide die produces average runs 35 times as long as steel dies.



2 Blanking and drawing of screw bottle caps is done by this die for Armstrong Cork Company, Lancaster, Pa. Die operated accurately on material .006" thick for months. Steel die had to be changed each week.

Case histories show how dies reduce costs when equipped with Carboloy® cemented carbide



3 Simple pierce and cutoff die, designed for Electric Auto-Lite Co., Toledo, operates at speeds faster than 400 strokes per minute. Die has produced over 2,000,000 strokes . . . and still does not require sharpening.

Actual plant performance has proved how easy and profitable it is to use Carboloy cemented carbide over a wide range of applications. For blanking, forming, drawing and piercing . . . for large or small, simple or complex dies . . . only carbides will give you benefits like these:

- **Production runs 35 times greater than steel (see picture No. 1)**
- **Accurate tolerances held for months . . . as compared to days with steel (see picture No. 2)**
- **Over two million high-speed strokes . . . without needing resharpening (see picture No. 3)**

If you wish, a member of the Carboloy Engineering Appraisal Service will call at your plant, without obligation. He'll show you how simple it is to wear-proof your dies; how to get increased production with fewer rejects. And you can send your key personnel to the Carboloy Die School in Detroit.

Also free is the Carboloy Die Engineering Manual D-124. It shows you how easy it is to design, apply and maintain carbide dies. For any of these free, cost-reducing Carboloy services or literature, send coupon below.

CARBOLOY
DEPARTMENT OF GENERAL ELECTRIC COMPANY

"Carboloy" is the trademark for products of the Carboloy Department of General Electric Company

FILL OUT THIS COUPON—MAIL IT TODAY!

CARBOLOY Department of General Electric Company
11147 E. 8 Mile Blvd., Detroit 32, Michigan

- ☐ Rush me free Carboloy Die Engineering Manual D-124.
- ☐ Send complete details on free Carboloy Die Training School.
- ☐ Have a representative of the Carboloy Engineering Appraisal Service call at my plant, at no obligation to me.

Name_____ Title_____

Company_____

Address_____

City_____ Zone_____

State_____

For more information on products advertised, use Inquiry Card, page 243

Product Directory

To find headings easily, look for capital letters at top of each page to denote locations.

ABRASIVE CLOTH, Paper and Belt
Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

ABRASIVES
See Discs, Abrasive

ABRASIVES, HONING
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.

ABRASIVES, Polishing, Tumbling, Etc.
Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Simonds Abrasive Co., Tacony and Fraley Sts., Bridesburg, Philadelphia, Pa.

ACCUMULATORS, Hydraulic
American Steel Foundries, Elmes Engineering Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Farquhar, A. B., Div. Oliver Corp., 142 North Duke St., York, Pa.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Lake Erie Engrg. Corp., Kenmore Sta., Buffalo, N. Y.
Morgan Engineering Co., Alliance, Ohio
Vickers, Inc., 1402 Oakman Blvd., Detroit, Mich.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.



● See someone using a wrench with confidence and ease — getting maximum turning power in the most inaccessible spots — and chances are you'll find he's using a Williams "Superrench".

These wrenches are designed right — drop-forged from selected alloy steel — they're unbelievably strong, light in weight, well balanced. And, there is a wide range of patterns with openings from 3/16" to 3-1/8".

If you have any idea that all wrenches are alike — try a Williams "Superrench" and feel the difference.



WRITE FOR CATALOG 201 detailing the new improvements and additions to the line . . . or ask your local distributor.

WILLIAMS
INDUSTRIAL TOOLS
"The Broadest Line of Its Kind"



PLUS local service from a Williams Distributor
J. H. WILLIAMS & CO. 407 Vulcan Street Buffalo 7, N. Y.

AIR HOISTS—See Hoists, Air.

AIR TOOLS—See Grinders, Pneumatic; Drills, Portable Pneumatic, Etc.

ALLOY STEELS
Allegheny Ludlum Steel Corp., Pittsburg, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Columbia Tool Steel Co., Lincoln Hwy. & State St., Chicago Heights, Ill.
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Republic Steel Corp., Union Drawn Steel Div., Republic Bldg., Cleveland, Ohio.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp., Carnegie-Illinois Steel Corp. Div., 436 7th Ave., Pittsburgh, Pa.
Vanadium Alloys Steel Co., Latrobe, Pa.
Wheelock, Lovejoy & Co., Inc., Cambridge, Mass.

ALLOY STEELS, High Temperature
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.

ALLOYS, Non-Ferrous
American Brass Co., 25 Broadway, New York.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Mueller Brass Co., Port Huron 35, Mich.
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.

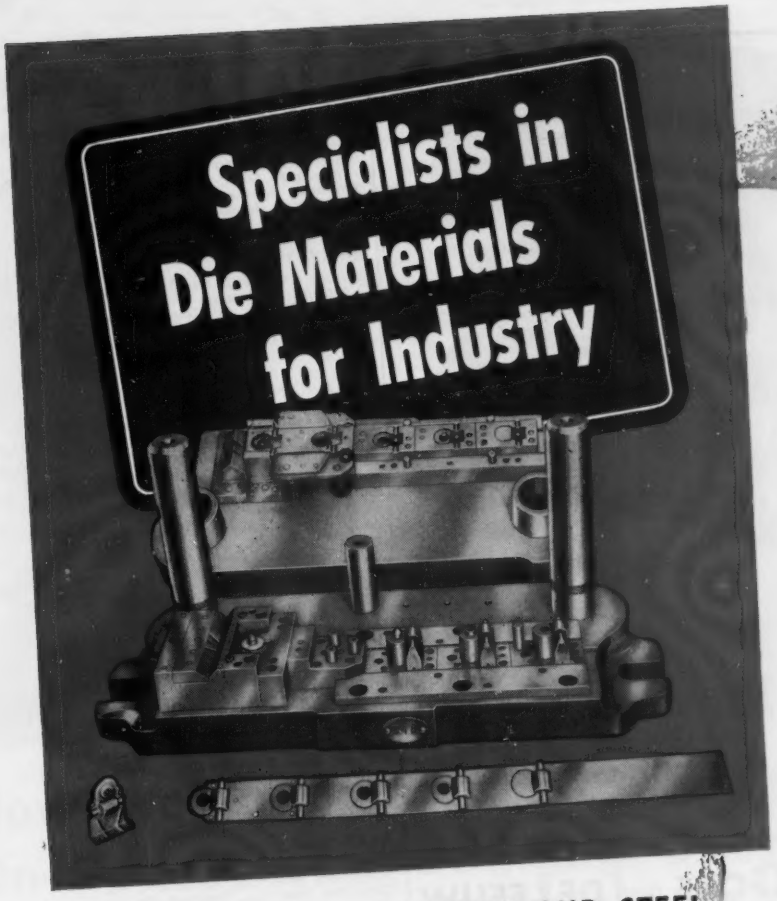
ALLOYS, Zinc
New Jersey Zinc Co., 160 Front St., New York, N. Y.

ARBOR PRESSES
See Presses, Arbor

ARBORS AND MANDRELS
Amco Gage Co., 19760 W. 8 Mile Rd., Detroit 19, Mich.
Beaver Tool & Engineering Corp. (Arbors only), 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Brown & Sharpe Mfg. Co., Providence, R. I.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Cincinnati Milling Machine Co., Oakley, Cincinnati, Ohio.
Danly Machine Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Gorton, George Mch. Co., 1110 W. 13th St., Racine, Wis.
Jacobs Mfg. Co., West Hartford, Conn.
Kempsmith Machine Co., 1819 S. 71st St., Milwaukee 14, Wis.
Keo Cutters, 19326 Woodward, Detroit, Mich.
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.
National Twist Drill & Tool Co., Rochester, Mich.

(*Continued on page 298*)

For more information on products advertised, use Inquiry Card, page 243



A COMPLETE LINE...CARBIDE AND STEEL

● Firth Sterling offers manufacturers and fabricators the advantages of a *single* source of supply of materials for both tungsten carbide and steel shaping, forming, piercing, heading and other dies. This *complete* line, from famous Firthaloy, for maximum performance where carbide is a requirement, through almost one hundred grades of high speed and tool steels for cut-off knives, roll guides, die casings, forming rolls and similar applications, provides the exactly right material for each application. Maximum production at lowest cost is thus assured.

Standard items are available from warehouse stocks; others may be obtained from your local tool and diemaker.

Firth Sterling representatives are skilled in interpreting the needs of industry and in suggesting the exactly right steel or carbide for specific applications. Because they know and sell both, you can depend on their unbiased recommendations to result in better, more economical tooling.

Attention: Fastener Industry! C.H.Q. Die Steel makes cold heading records



C.H.Q. solid die after 192,000 run.

A nationally known fastener manufacturer* recently made comparative tests of solid steel cold heading dies, under carefully controlled conditions, producing ⅝" square head machine bolts from 1020 steel on a Waterbury Farrel double stroke automatic.

Firth Sterling C.H.Q. came off with top honors and the highest production ever obtained by this manufacturer from any steel die . . . 192,045 both ends. (78,860 one end, 59 Rockwell C; 113,185 other end, 61 Rockwell C.) Standard competitive carbon steel dies produced only 50,000-60,000 both ends and ultimately failed by cracking axially. The C.H.Q. die wore oversize but longitudinally etched section revealed not even a hairline crack.

Ask for technical literature on C.H.Q.—or a Firth Sterling representative will discuss your die problems.

*(name on request)

R-299-A

Firth Sterling

—INC—

GENERAL OFFICES: 3113 FORBES ST., PITTSBURGH 30, PA.

OFFICES AND WAREHOUSES*: BIRMINGHAM CHICAGO* CLEVELAND DAYTON DETROIT* HARTFORD* HOUSTON LOS ANGELES* NEW YORK PHILADELPHIA PITTSBURGH WASHINGTON WESTFIELD, N.J.

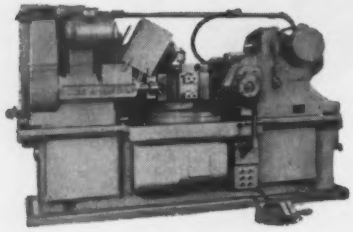
PRODUCTS OF FIRTH STERLING METALLURGY

High Speed Steels
Tool & Die Steels
Stainless Specialties
High Temperature Alloys
Sintered Tungsten Carbides
Firth Heavy Metal
Chromium Carbides
High Temperature Cermets
Zirconium

For more information on products advertised, use Inquiry Card, page 243

For more information on products advertised, use Inquiry Card, page 243





GOSS and DE LEEUW
CHUCKING
MACHINE

When any of the various functions for which this machine is designed are performed on it, no further machining is required. The job is finished.

The basic "1-2-3" method—exclusive with Goss & DeLeeuw—provides for gripping work in the chuck and machining all ends either simultaneously or in sequence. By eliminating several handlings and set-ups, the "1-2-3" method produces finished pieces at a fraction of the time and cost ordinarily required.



Send samples of your work for time estimates. Ask for illustrated literature containing detailed information.

GOSS & DE LEEUW
QUALITY PRODUCT-QUANTITY

GOSS and DE LEEUW
MACHINE COMPANY, KENSINGTON, CONN., U.S.A.

Pratt & Whitney, West Hartford 1, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Supreme Products, Inc., 2222 So. Calumet, Chicago 16, Ill.
Union Twist Drill Co., Athol, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

BABBITT

Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Johnson Bronze Co., New Castle, Pa.
Ryerson, Jos. T., & Son, 2558 W. 16th St., Chicago 18, Ill.

BALANCING EQUIPMENT

Anderson Bros. Mfg. Co., 1910 Kishwaukee St., Rockford, Ill.
Casa Corp., 405 Lexington Ave., New York 17.
Gisholt Machine Co. (Static and Dynamic), 1245 E. Washington Ave., Madison 10, Wis.
Keller Tool Co., Grand Haven, Mich.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
Olsen, Tinius, Testing Machine Co., Philadelphia, Pa.
Pope Machinery Corp., Haverhill, Mass.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mich. Tool Co., 2531 11th St., Rockford, Ill.

BALLS

Kennametal, Inc., Latrobe, Pa.

BARS, Phosphor Bronze

Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Johnson Bronze Co., New Castle, Pa.

BARS, Steel

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Republic Steel Corp., Union Drawn Steel Div., (Cold Drawn), Republic Bldg., Cleveland, Ohio.
Ryerson Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Summerill Tubing Co., Div. Columbia Steel & Shafting Co., P. O. Box 1557, Pittsburgh 30, Pa.
Timken Roller Bearing Co., Canton, Ohio.
U. S. Steel Corp. (American Steel & Wire Co. Div., Carnegie-Illinois Steel Corp. Div., Columbia Steel Co. Div., Tennessee Coal, Iron & R. R. Co. Div.), 436 7th Ave., Pittsburgh, Pa.
Wheelock, Lovejoy & Co., Inc., Cambridge, Mass.

BASES, Machinery Welded

Mahon, R. C., Co., 6565 E. 8 Mile Rd., Detroit 34, Mich.

BEARINGS, Babbitt

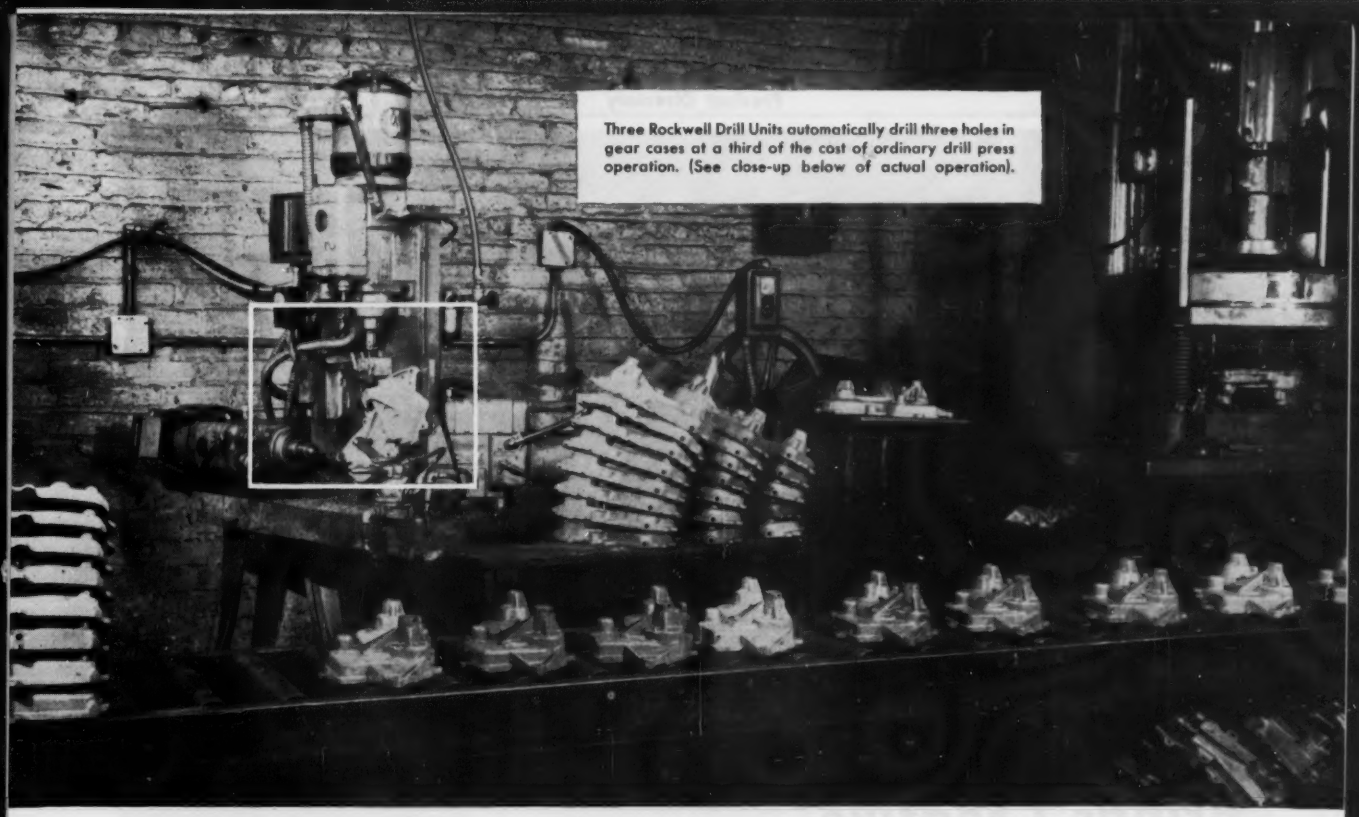
Bunting Brass & Bronze Co., Spencer and Carlton Ave., Toledo, Ohio.
Johnson Bronze Co., New Castle, Pa.
Link-Belt Co., 2410 W. 18th St., Chicago 8, Ill.

BEARINGS, Ball

Ball & Roller Bearing Co., Danbury, Conn.
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Fafnir Bearing Co., New Britain, Conn.
Kaydon Engineering Corp., McCracken St., Muskegon, Mich.
Link-Belt Co., 519 N. Holmes Ave., Indianapolis 6, Ind.
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
New Departure Div., General Motors, Bristol, Conn.
Nice Ball Bearing Co., Nicetown, Philadelphia, Pa.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Torrington Co., Torrington, Conn.

(*Continued on page* 300)

For more information on products advertised, use Inquiry Card, page 243



Three Rockwell Drill Units automatically drill three holes in gear cases at a third of the cost of ordinary drill press operation. (See close-up below of actual operation).

How Woodruff and Edwards Cut Cost 61.77% On Gear Case Machining Operation With Rockwell* Drill Units

Before tooling up to machine gear cases that were to be produced under contract *for the Whirlpool Corporation, Woodruff and Edwards, Inc.* (Elgin, Illinois, foundry and production jobbing firm) conducted comparative cost studies of conventional drill presses versus Rockwell Air-Hydraulic Drill Units. The operation involved drilling three holes at various angles into the gear case. It was determined that these operations performed on drill presses would require 1.04 minutes, at a cost of $.0936 per part.

On the basis of this cost study, Woodruff and Edwards installed three Rockwell Drill Units on a simple weldment, around an inexpensive holding fixture. With this shop built machine, they do the job in 0.4 minutes floor to floor time, at a cost of $.036 per part—a saving of 61.77%.

Richard W. Hampel, Superintendent of Woodruff and Edwards' Manufacturing Division, points out: "They could do even better if we'd let them. Our Rockwell Drill Units operate at the station following the automatic boring machine, and output is limited by the boring machine's cycle time.

"Our Drill Unit machine is operated by the boring machine operator on idle time, giving us practically a free operation." This is one of the advantages of remote-automatic operation.

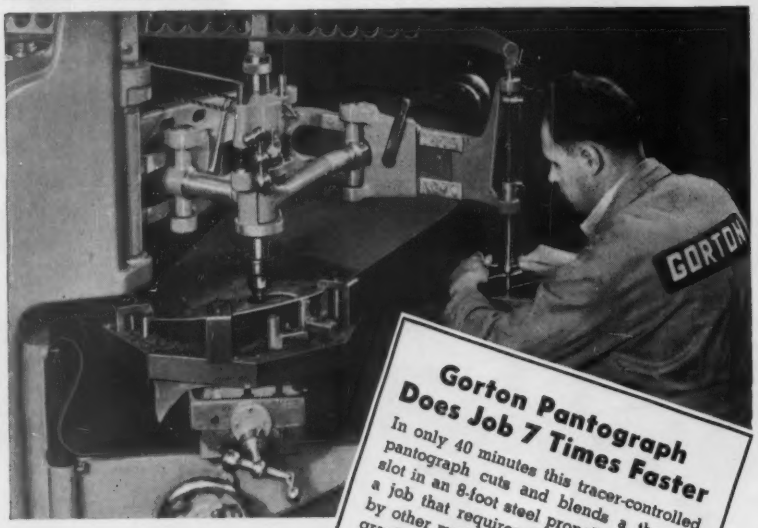
Rockwell Drill Units are available for plant demonstration through Rockwell Sales Engineers, who are also equipped to offer engineering aid in conducting cost studies on operations involving production drilling, tapping, counter-boring and similar operations.

Full information is available by writing to: Drill Unit Division, Rockwell Manufacturing Company, 302J North Lexington Avenue, Pittsburgh 8, Pa.



Triggered by the air clamp that secures the gear boxes, the Rockwell Drill Unit machine: (a) drills a ⅝" hole at a 45° angle through the underside of the casting; (b) drills a ⅞" hole vertically through a 1½" boss; and (c) with a Letter "R" drill, drills an oil plughole. All three units retract independently.





Gorton Pantograph Does Job 7 Times Faster

In only 40 minutes this tracer-controlled pantograph cuts and blends a thermal slot in an 8-foot steel propeller blade — a job that requires 5 hours 10 minutes by other methods. This is typical Pantograph performance — one of hundreds of examples.

Gorton Pantography Brings *Creative* Production to Your Plant

What's *your* problem in machining? Depend on Gorton Pantography to help you *create* a new production method if your problem falls into any of these categories:

OPERATIONS

Inside profiling	Counterboring
Outside profiling	Chamfering
Routing	Grooving
Die sinking	Graduating
Mold cutting	Engraving

MATERIALS
Ferrous metals
Non-ferrous metals
Plastics

SHAPES
Flat
Uniformly curved
Cylindrical
Square
Spherical
Irregular

Gorton Pantography works in two or three dimensions, in all directions on a horizontal plane, and vertically. It uses enlarged masters, templates or patterns — easily and inexpensively made. Normal operation takes advantage of the reduction ratio principle for increased accuracy in the work piece — an exclusive pantograph benefit.

Whether a dozen or a thousand pieces, each is identical in shape and tolerances to the first. Operation during cutting cycle is manual or automatic, and work piece size varies from the diameter of a dime to areas as large as ten feet.

Clip the coupon for your copies of the Gorton catalog and the helpful booklet, "Pantography."



GEORGE GORTON MACHINE CO.



1309 Racine St., Racine, Wis., U.S.A.

Please send at once complete information about the Gorton line contained in Bulletin 1655-1309

Firm .....
Name .....
Title .....
Address .....
City, State .....

BEARINGS, Bronze and Special Alloy
Bunting Brass & Bronze Co., Spencer & Carlton Aves., Toledo, Ohio.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Johnson Bronze Co., New Castle, Pa.
Link-Belt Co., 2410 W. 18th St., Chicago 8, Ill.

BEARINGS, Lineshaft
Fafnir Bearing Co., New Britain, Conn.
Link-Belt Co., 519 N. Holmes Ave., Indianapolis 6, Ind.
Orange Roller Bearing Co., Inc., Orange, N. J.
Standard Pressed Steel Co., Jenkintown, Pa.

BEARINGS, Needle
Kaydon Engineering Corp., McCracken St., Muskegon, Mich.
Orange Roller Bearing Co., Inc., Orange, N. J.
Torrington Co., Torrington, Conn.

BEARINGS, Roller
Ball & Roller Bearing Co., Danbury, Conn.
Fafnir Bearing Co., New Britain, Conn.
Hyatt Bearings Div., Harrison, N. J.
Kaydon Engineering Corp., McCracken St., Muskegon, Mich.
Link-Belt Co., 519 N. Holmes Ave., Indianapolis 6, Ind.
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Orange Roller Bearing Co., Inc., Orange, N. J.
Rollway Bearings Co., Inc., 541 Seymour St., Syracuse, N. Y.
Timken Roller Bearing Co., Canton, Ohio.
Torrington Co., Torrington, Conn.

BEARINGS, Self-Lubricating (Oilless)
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Johnson Bronze Co., New Castle, Pa.

BEARINGS, Tapered Roller
Kaydon Engineering Corp., McCracken St., Muskegon, Mich.
Timken Roller Bearing Co., Canton, Ohio.
Torrington Co., Torrington, Conn.

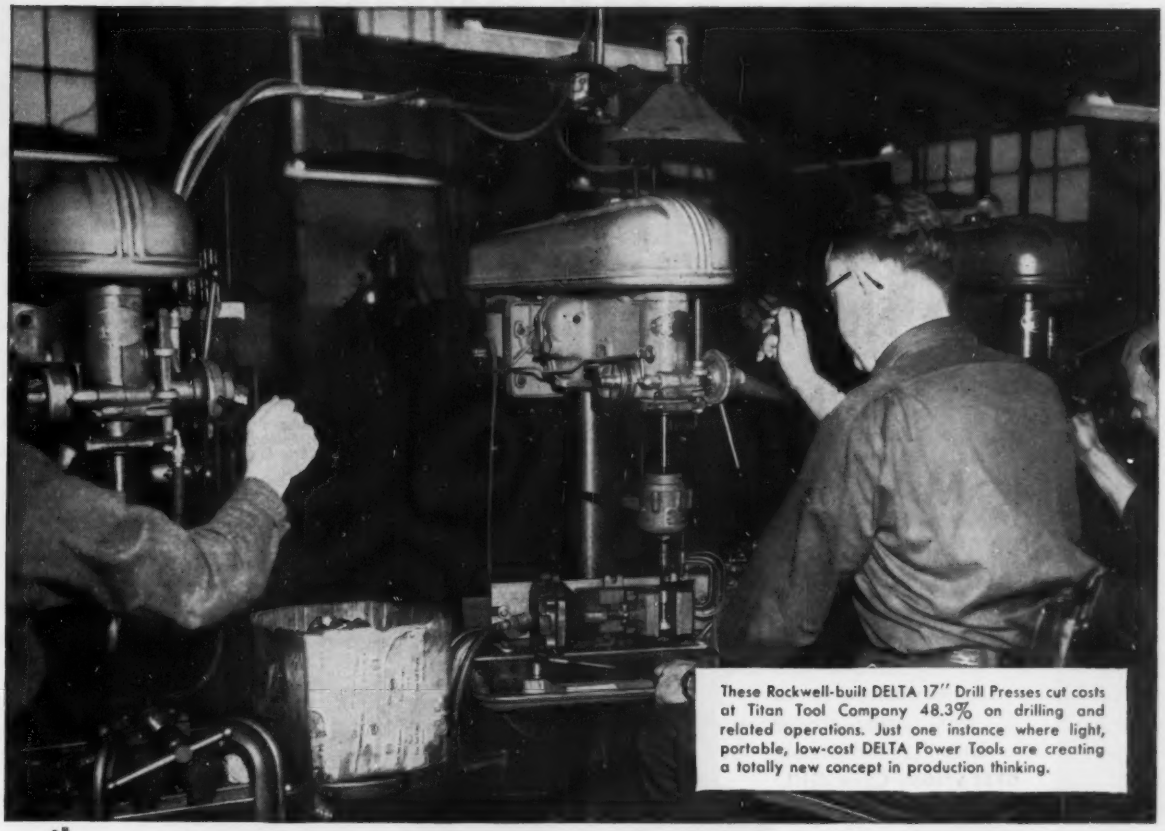
BEARINGS, Thrust
Ball & Roller Bearing Co., Danbury, Conn.
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Fafnir Bearing Co., New Britain, Conn.
General Electric Co., Schenectady, N. Y.
Kaydon Engineering Corp., McCracken St., Muskegon, Mich.
Link-Belt Co., 519 N. Holmes Ave., Indianapolis 6, Ind.
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
Nice Ball Bearing Co., Nicetown, Philadelphia, Pa.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Orange Roller Bearing Co., Inc., Orange, N. J.
Rollway Bearing Co., Inc., Syracuse, N. Y.
Timken Roller Bearing Co., Canton, Ohio.
Torrington Co., Torrington, Conn.

BELT SHIFTERS
Standard Pressed Steel Co., Jenkintown, Pa.

BELTING, TRANSMISSION
Houghton, E. F. & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Link-Belt Co., 220 S. Belmont Ave., Indianapolis 6, Ind.

(*Continued on page* 302)

For more information on products advertised, use Inquiry Card, page 243



These Rockwell-built DELTA 17" Drill Presses cut costs at Titan Tool Company 48.3% on drilling and related operations. Just one instance where light, portable, low-cost DELTA Power Tools are creating a totally new concept in production thinking.

"Added DELTA Drill Presses... CUT PRODUCTION COSTS 48.3%"

"When we put our new DELTA 17" Drill Presses into production, costs of drilling and related operations in that department dropped 48.3%," comments J. W. McKean, Superintendent of Titan Tool Company, Fairview, Pennsylvania. Titan manufactures 90% of the stud-setting tools used by the automotive and aviation industries.

"Almost as important as the savings they've shown," reports Mr. McKean, "is the ease with which we can move them from place to place when required, and their adaptability to all types of jigs and fixtures. We like DELTA's ability to stand up under constant operation, day after day, with complete accuracy, and practically no maintenance. Next time we buy drill presses, they'll be DELTA, you can count on it."

Titan is one of thousands of companies who are trimming costs with Rockwell-built DELTA Power Tools. In fact, the use of portable, inexpensive, accurate *DELTA Tools to augment*—or replace—*heavy, expensive machine tools has become a powerfully growing trend throughout the metalworking industry. It's the practical answer to rising costs, and it can be your answer, too. Talk to your DELTA Dealer; he's listed in the classified pages of your phone book under "TOOLS" or "MACHINERY." Or send the coupon for complete catalog information.*

DELTA QUALITY POWER TOOLS

Another Product by **Rockwell**

DELTA ROCKWELL

DELTA QUALITY MAKES THE DIFFICULT!

Delta Power Tool Div., Rockwell Manufacturing Co.
1413 North Lexington Ave., Pittsburgh 8, Pa.

☐ Please send DELTA AB-54 Catalog.
☐ Please send name of my nearest DELTA Dealer.

Name_____ Title_____

Company_____

Address_____

City_____ County_____ State_____

Another Cleveland Design to Speed Production!

CLEVELAND NUT TAPPING MACHINE



OPERATION: Core drill and tap cast iron nuts ⅝" through 1½"

Produces 1020—⅞"—9 Pitch Cast Iron Nuts per hour @ 100% Efficiency

DESCRIPTION: A vertical F-2 type Cleveland Heavy Duty Machine with eight spindle multiple head and a double slide four track feeder. The feeder fixture has a double slide mounted on hardened and ground slide bars to slide back approximately 3½" picking up a new part at end of each four tracks and at the same time picking up the drilled part at the drill position; then to slide forward to a fixed position and hold the parts at drill and tap position; at the same time the finished parts will be discharged onto a delivery chute at the rear of the tap spindles. The operator loads the nuts from a large tray in front of machine into magazine.



Send for your copy of this Guide

Write today for Catalog No. MY-94

CLEVELAND tapping machine co.

A Subsidiary of AUTOMATIC STEEL PRODUCTS, INC. • CANTON 6, OHIO



BENCHES, Work, and Bench Legs
Standard Pressed Steel Co., Jenkintown, Pa.

BENDING MACHINES, Angle Iron, Plate, Etc.
Consolidated Mch. Tool Corp., 565 Blossom Rd., Rochester, N. Y.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.

BENDING MACHINES, Hydraulic
American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Chambersburg Engrg. Co., Chambersburg, Pa.
Farquhar, A. B., Div. Oliver Corp., 142 North Duke St., York, Pa.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Hydraulic Press Mfg. Co., 30 Lincoln Ave., Mt. Gilead, Ohio.
Lake Erie Engrg. Corp., Kenmore Sta., Buffalo, N. Y.
Morgan Engineering Co., Alliance, Ohio.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.

BENDING MACHINES, Pipe
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Farquhar, A. B., Div. Oliver Corp., 142 North Duke St., York, Pa.
Watson-Stillman Co., Div., H. K. Porter Co., Inc., Roselle, N. J.

BLAST CLEANING EQUIPMENT
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Pangborn Corp., Hagerstown, Md.
Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

BLOWERS
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.

BLUING LAYOUT
Dykem Co., 2303 P. N. 11th St., St. Louis 6, Mo.

BOILER TUBES
Bethlehem Steel Co., Bethlehem, Pa.
Republic Steel Corp., Steel and Tubes Div., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp., National Tube Co., Div., 436 7th Ave., Pittsburgh, Pa.

BOLT AND NUT MACHINERY
Ajax Mfg. Co., Euclid, Cleveland 17, Ohio.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Landis Machine Co., Inc., Waynesboro, Pa.
National Machinery Co., Tiffin, Ohio.
New Britain Machine Co., New Britain-Gridley Mch. Div., New Britain, Conn.

BOLTS AND NUTS
Allmetal Screw Products Co., Inc., 821 Stewart Ave., Garden City, N. Y. (Stainless Steel only)
Bethlehem Steel Co., Bethlehem, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Ottemiller, W. H., & Co., York, Pa.
Republic Steel Corp., Bolt & Nut Div., Republic Bldg., Cleveland 1, Ohio.
Russell, Burdsall & Ward Bolt & Nut Co., 100 Midland Ave., Port Chester, N. Y.

BOLTS, T-Slot
O. K. Tool Co., Milford, N. H.

(*Continued on page* 304)

For more information on products advertised, use Inquiry Card, page 243

Announcing

MILLING CUTTERS *and* END MILLS *by* Butterfield



With the addition of Milling Cutters and End Mills, Butterfield now offers a full line of metal cutting tools. Milling Cutters and End Mills are made to the same exacting standards of dependability and extra performance which mark Butterfield's Taps, Dies, Drills, Reamers, Counterbores, and Screw Plates.

BUTTERFIELD

UNION TWIST DRILL COMPANY
BUTTERFIELD DIVISION
DERBY LINE, VERMONT, U.S.A.

TAPS · DIES · DRILLS · REAMERS · COUNTERBORES · SCREW PLATES · MILLING CUTTERS · END MILLS

FOR BETTER SERVICE
CALL YOUR
BUTTERFIELD
DISTRIBUTOR

ANSWERS TO YOUR PUMP PROBLEMS



CATALOG 101—(Model L Series) Mechanically-sealed pumps in capacities from ½ to 6 g.p.m. and pressures to 600 p.s.i.

These New TUTHILL Catalogs Give You Complete Data on Pumps for LUBRICATION, HYDRAULIC, COOLANT, TRANSFER and BURNING OILS SERVICE.



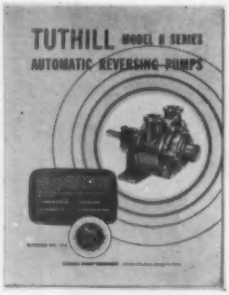
CATALOG 102—(Model C Series) General purpose pumps in capacities from 2 to 200 g.p.m. and pressures to 100 p.s.i.



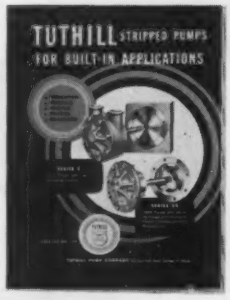
CATALOG 103—(Model CK Series) High pressure pumps in capacities from 5 to 200 g.p.m. and pressures to 400 p.s.i.



CATALOG 104—(Model M Series) Coolant pumps with automatic internal by-pass. Capacities from 2 to 50 g.p.m. and pressures to 15 p.s.i.



CATALOG 105—(Model R Series) Automatic reversing pumps in capacities from ¾ to 200 g.p.m. and pressures to 100 p.s.i.



CATALOG 106—(Types S and SA) Stripped pumps for built-in applications. Capacities from ½ to 200 g.p.m. and pressures to 100 p.s.i.



CATALOG 107—(Type SU) Multiple V-belt pumping units in capacities from 2 to 50 g.p.m. and pressures to 300 p.s.i.

Tuthill pumps are of the rotary, internal-gear, positive displacement type.
Any one or more of these Tuthill catalogs are available on request. They include individual pump guides to help you select the Tuthill pump best-suited to your requirements. Please ask for catalogs by number.

TUTHILL PUMP COMPANY
Dependable Rotary Pumps since 1927
939 East 95th Street, Chicago 19, Illinois

Canadian Affiliate—Ingersoll Machine & Tool Co., Ltd.
Ingersoll, Ontario, Canada

BOOKS, Technical
Industrial Press, 148 Lafayette St., New York 13, N. Y.
Lincoln Electric Co., 22801 St. Clair Ave., Cleveland, Ohio.

BORING AND DRILLING MACHINES
Baker Bros., Inc., Sta. F, P. O. Box 101, Toledo 10, Ohio.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Canedy-Otto Div. Cincinnati Lathe & Tool Co., Oakley, Cincinnati, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland 8, Ohio.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Turner Bros., Inc., 2625 Hilton Rd., Ferndale 20, Mich.

BORING AND TURNING MILLS, Vertical
American Steel Foundries, King Mch. Tool Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.

BORING BARS
Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling, Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Homestrand Inc., Larchmont, N. Y.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Lehmann Machine Co., 3560 Chouteau Ave., St. Louis, Mo.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Universal Engineering Co., Frankenmuth 2, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

BORING, DRILLING AND MILLING MACHINES, Horizontal
(Floor, Planer or Table Types)
Cincinnati Gilbert Machine Tool Co., 3366 Beekman St., Cincinnati 23, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17.
Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
Ex-Cell-O Corp., 120 Oakman Blvd., Detroit 32, Mich.
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray, G. A., Co., Woodburn Ave. and Penn. R. R., Evanston, Cincinnati, Ohio.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Lucas Mch. Tool Div., New Britain Mch. Co., 12302 Kirby Ave., Cleveland 8, Ohio.
Millholland, W. K., Machinery Co., 6402 Westfield Blvd., Indianapolis 5 Ind.

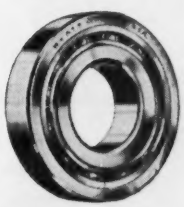
(*Continued on page* 306)

For more information on products advertised, use Inquiry Card, page 243



Gas-Turbine-Powered Pump on Test at Navy Fire Fighting School

Where Hyatts turn at 40,000 rpm!



Old in theory, gas turbines are comparatively new as a practical power source. So it was big news in engine development when Solar Aircraft Company, of California, announced the world's first portable, hand-started gas turbine power plant.

Developing 50 horsepower, the new lightweight operates at the high speed of 40,000 rpm—or twenty times the speed of most automobile engines! And that's where *we* come in.

To be sure of complete bearing dependability for such high-speed operation, Solar turned to Hyatt . . . and there's a Hyatt Hy-Load Roller Bearing at the most critical position on the turbine shaft.

Whether you're building locomotives or lawn mowers, and whether shafts turn at 4 or 40,000 rpm, you'll get better bearing performance from *Hyatts!*

HYATT

STRAIGHT ROLLER BARREL ROLLER TAPER ROLLER

ROLLER BEARINGS

HYATT BEARINGS DIVISION • GENERAL MOTORS CORPORATION • HARRISON, NEW JERSEY

Get the advantages of magnetic chucking...
FOR BENCH WORK
...FOR SMALL MACHINE TOOLS



Magna-Lock
ELECTRO-MAGNETIC CHUCKS

These small chucks—5" x 10", 6" x 12", 6" x 18", 10" x 15" working surfaces—eliminate costly fixtures, give you all the features of the larger Magna-Locks: 22% more magnetic area than other types, rugged welded *all-steel* construction, dependable moisture-proof, shock-proof electrical circuits. Complete standard accessories available.

Get details, DEPT. M-94.

Request Magna-Lock as *original* equipment on your new machines.



Hanchett MAGNA-LOCK CORPORATION
Magna-Lock
Magnetic Chucks and Devices
BIG RAPIDS, MICHIGAN, U.S.A.

Modern Ind. Engrg. Co. 14230 Birwood Ave., Detroit 4, Mich.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Turner Bros., Inc., 2625 Hilton Rd., Ferndale 20, Mich.

BORING HEADS

Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Millholland, W. K., Machinery Co., 6402 Westfield Blvd., Indianapolis 5 Ind.
Mummert-Dixon Co., Hanover, Pa.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Universal Engineering Co., Frankenmuth 2, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

BORING MACHINES

Bryant Chucking Grinder Co., Springfield, Vt.
Chandler Tool Co., 514 Ohio Ave., Muncie, Ind.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Heald Machine Co., 10 New Bond St. Worcester 6, Mass.
Millholland, W. K., Machinery Co., 6402 Westfield Blvd., Indianapolis 5 Ind.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
National Automatic Tool Co., Inc., S. 7th and N Sts., Richmond, Ind.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Simplex Machine Tool Corp., 4528 W. Mitchell St., Milwaukee, Wis.

BORING MACHINES, Jig

American Sip Corp., 100 E. 42nd St., New York 17, N. Y.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Cleereman Mch. Tool Co., Green Bay, Wis.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Kearney & Trecker Corp., Milwaukee, Wis.
Moore Special Tool Co., Inc., 724 Union Ave., Bridgeport, Conn.
Pratt & Whitney, West Hartford 1, Conn.
Scherr, George, Co., Inc. 200 Lafayette St., New York 12, N. Y.

BORING TOOLS

American Steel Foundries, King Mch. Tool Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Carboloy Dept., General Electric Co., Box 237 Roosevelt Park Annex, Detroit 32, Mich.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling, Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gairing Tool Co., 21225 Hoover Rd., Detroit, Mich.
Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Kennametal, Inc., Latrobe, Pa.
Lehmann Machine Co., 3560 Chouteau Ave., St. Louis, Mo.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Metal Carbides Corp., Youngstown, Ohio.

(*Continued on page* 308)

For more information on products advertised, use Inquiry Card, page 243

Why you can *lower inspection costs*

with a Kodak Conju-Gage Gear Checker

Why the composite check

The composite check recommended in American Standard B6.11-1951 tests gears functionally by running the gear against a master of known accuracy. The resulting displacement shows at once the cumulative effect of as many as six types of error—eliminates time-consuming checks for each individual error. The check is rapid and conclusive.

Why the Kodak Conju-Gage Gear Checker

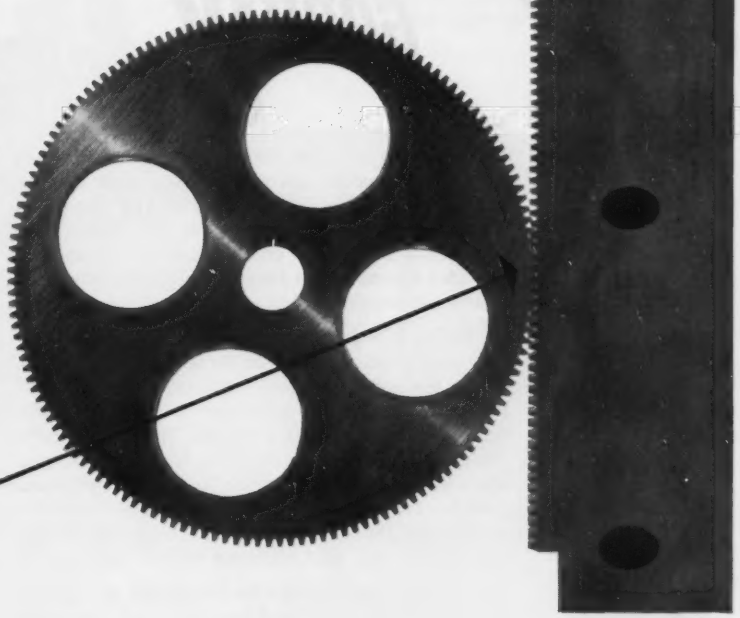
To meet today's tolerance requirements, the Kodak Conju-Gage Gear Checker uses a master made with a new order of precision. This is the Kodak Conju-Gage Worm Section, produced by thread grinding under control of a precision lead screw.

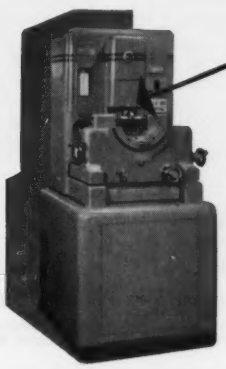
The accuracy inherent in this method means every right gear is passed by the worm section, reducing rejection losses. The transverse curvature produced by this method provides a master that can be used to check any gear of like pitch and pressure angle, regardless of helix.

Not only can a single worm section be used in place of a number of circular masters, but such a worm section can be reground to specification as often as necessary—at a fraction of replacement cost. It is easily checked for accuracy by familiar toolroom procedures.

You can find out more about the economies possible through Kodak Conju-Gage Instrumentation by sending for a copy of the booklet, "Kodak Conju-Gage Gear Testing Principle." Write to:

Special Products Sales Division
EASTMAN KODAK COMPANY
Rochester 4, N. Y.





The Kodak Conju-Gage Gear Checker automatically records the composite effects of runout, base pitch error, tooth thickness variations, profile error, lead error, and lateral runout. Illustrated is the Kodak Conju-Gage Gear Checker, Model 4U, for gears up to 4⅛" pitch diameter. Larger and smaller models are also available.

CONJU-GAGE INSTRUMENTATION

... a new way to check gear precision in action

To inspect all kinds of complex parts on a bright screen, Kodak also makes two highly versatile contour projectors.

Kodak

For more information on products advertised, use Inquiry Card, page 243

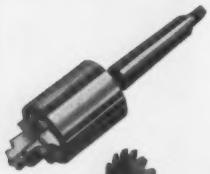


for Special Service on Carbide "Specials"

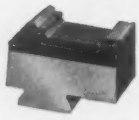
GORHAM

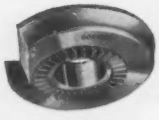
GORHAM

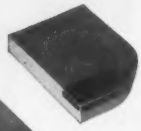
GORHAM











When your production machining problem dictates the use of special carbide tooling, your nearby Gorham Field Engineer can give you the right answers fast! He's an expert in the design and application of special cutting tools . . . and he provides a complete engineering service to determine your exact requirements.

He begins with your product, sketch or idea. He surveys your production operations and available equipment. He considers work material properties and required finishes and tolerances. He plots speeds, feeds and methods of tool driving. Then he develops practical design and metallurgical specifications for a special tool that's "tailor-made" for your application. And his recommendations are backed by Gorham's more than thirty years' experience in the design, manufacture and heat treatment of fine cutting tools.

Yes, your nearby Gorham Field Engineer is a helpful man to have around! If you haven't yet met him, write for his name, or send details of your problem direct, and we'll have him get in touch with you promptly.



Gorham TOOL COMPANY

"EVERYTHING IN STANDARD AND SPECIAL CUTTING TOOLS"

14405 WOODROW WILSON DETROIT 3, MICHIGAN

WEST COAST WAREHOUSE: 576 North Prairie Ave., Hawthorne, Calif.

Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Union Twist Drill Co., Athol, Mass.
Universal Engineering Co., Frankenmuth 2, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

BRAKES, Press and Bending

Bliss E. W., Co., 1375 Raff Road, S. W., Canton, Ohio.
Cincinnati Shaper Co. Elam and Garrard Aves., Cincinnati, Ohio.
Cleveland Crane & Engrg. Co., Wickliffe, Ohio.
Columbia Div., Lodge & Shipley Co., Hamilton 1, Ohio.
Dreis & Krump Mfg. Co., 7416 Loomis Blvd., Chicago 36, Ill.
Ferracute Machine Co., Bridgeton, N. J.
Verson Allsteel Press Co., 93rd St. and S. Kenwood Ave., Chicago, Ill.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.

BROACHES

American Broach & Mch. Co., Ann Arbor, Mich.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Colonial Broach Co., P. O. Box 37, Harper Sta., Detroit, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Lapointe Mch. Tl. Co., Tower St., Hudson, Mass.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

BROACHING MACHINES

American Broach & Mch. Co., Ann Arbor, Mich.
Cincinnati Milling Mch. Co., Cincinnati, Ohio.
Colonial Broach Co., P. O. Box 37, Harper Sta., Detroit, Mich.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Foote-Burt Co., 130 St. Clair Ave., Cleveland 8, Ohio.
Lapointe Mch. Tl. Co., Tower St., Hudson, Mass.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4, Wis.
Wilson, K. R., 213 Mill St., Arcade, N. Y.
Zagar Tool Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

BRONZE

American Brass Co., Waterbury 20, Conn.
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Johnson Bronze Co., New Castle, Pa.
Mueller Brass Co., Port Huron 35, Mich.

BRUSHES, Industrial, Wire Wheel, Etc.

Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland, Ohio.

BUFFERS

Black & Decker Mfg. Co., E. Penna. Ave., Towson, Md. (Portable Elec.).
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Hammond Machinery Builders, Inc., 1600 Douglas Ave., Kalamazoo 54, Mich.

BULLDOZERS

Ajax Mfg. Co., Euclid, Cleveland 17, Ohio.
American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Chambersburg Engrg. Co., Chambersburg, Pa.
Lake Erie Engineering Corp., Kenmore Station, Buffalo, N. Y.
Watson-Stillman Co., Div., H. K. Porter Co., Inc., Roselle, N. J.

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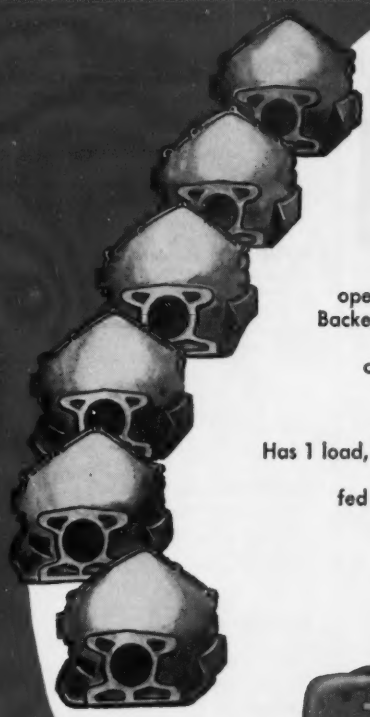
For more information on products advertised, use Inquiry Card, page 243

6080 OPERATIONS PER HOUR

with one operator

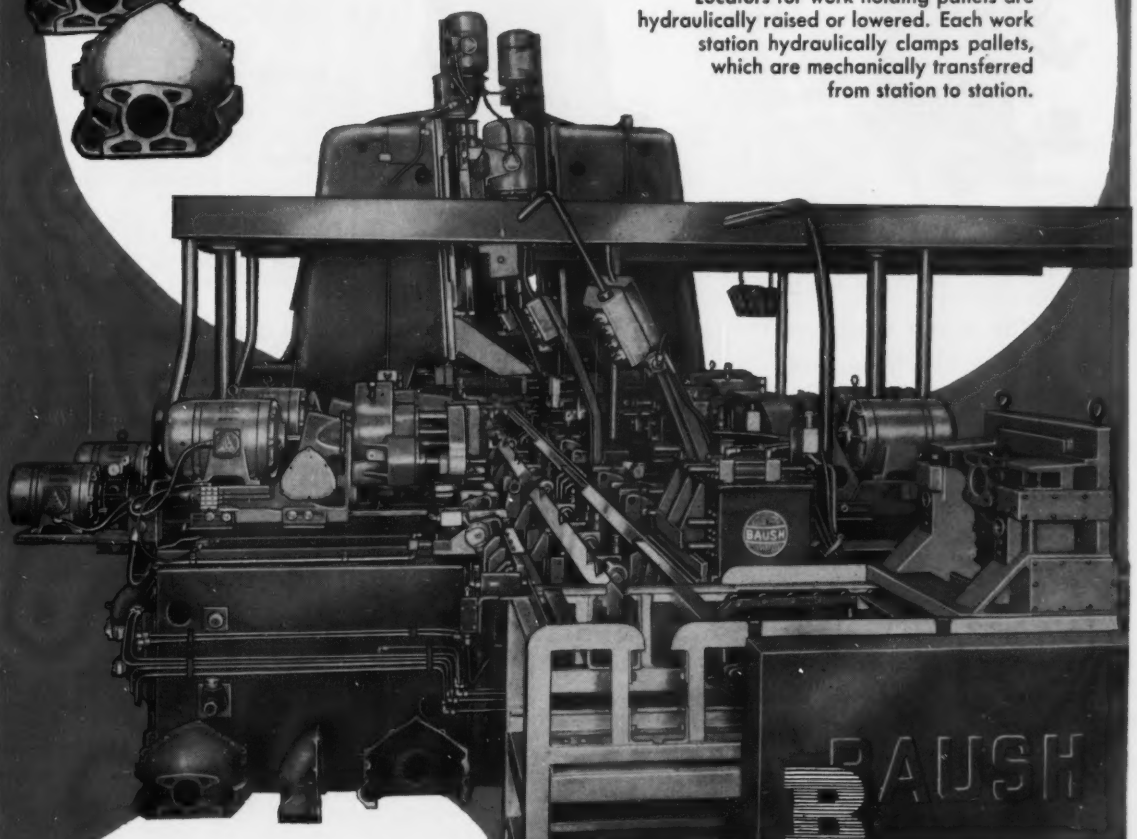
Baush 9-Station Mechanical Transfer speeds machining operations and lowers production costs on automotive clutch housings.

There's no questioning production efficiency and low costs when operations can be speeded and simplified in this way.
Backed by over 50 years of designing and building automatic machine tools, Baush Engineers can be of real help to you in solving your machine operations. Why not send us your prints NOW — there is no obligation, and our staff would enjoy working with you on your problems.



9-STATION MECHANICAL TRANSFER:

Has 1 load, 6 work, and 2 idle stations with 11 mechanical power units and 3-way checking fixture. . . . Three 3-position mechanical transfer bases are fed by automatic pallet conveyor with 11 pallets. Hydraulic clamping and unloading of part in work-holding pallets. Locators for work holding pallets are hydraulically raised or lowered. Each work station hydraulically clamps pallets, which are mechanically transferred from station to station.



OPERATIONS:

Drill, rough bore and ream, counterbore, spotface, chamfer and tap for a total of 64 operations in each clutch housing.

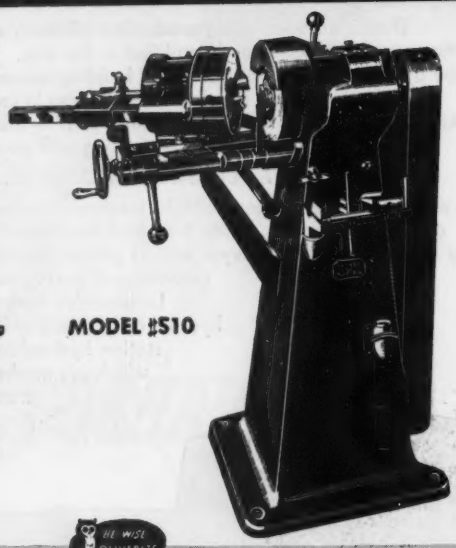
PRODUCTION:

95 clutch housings per hour at 100% efficiency, or a total of 6080 operations per hour with one operator.

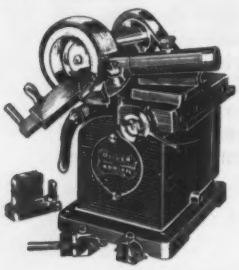
BAUSH
MACHINE TOOL CO.
SPRINGFIELD 7, MASSACHUSETTS

You, Like Thousands of Others, Can Reduce Drill Costs with OLIVER DRILL POINTERS

Twist Drills *machine-ground* the Oliver Way reduce drill costs because they cut faster, last longer and produce more perfect holes.



MODEL #510



MODEL #21

BE WISE OLIVERIZE

The unique feature of the OLIVER DRILL POINTER is its ability to give you the only scientifically correct and theoretically perfectly drill point. Each lip of the drill does equal work because the OLIVER grinds them to perfect balance. Moreover—OLIVER-ground drills last up to 3 times longer than hand-ground drills . . . assure you of uniformity.

Keep production schedules, eliminate excessive drill costs, imperfect holes and rejects. For the greatest increase in economy, wearing life and efficiency, remove your drills at the first sign of dullness and *machine-grind* them with OLIVER DRILL POINTERS.

No. 510 for drills ¼" to 3"—2-3-4 flute. Variable clearances. Variable point angles. Automatic operation.
No. 21 Oliver Bench Grinder. Hand operated for Drills No. 57 to ½". Right hand, with an improved point. Attachments are available for grinding oil hole drills, left hand and other special points.

Write for our free Booklet
"How To Produce More Holes With Your Drills!"
See our catalog in Sweet's Directory

MACHINE TOOLS by OLIVER include:
AUTOMATIC DRILL GRINDERS
TOOL & CUTTER GRINDERS
DRILL POINT THINNERS
TEMPLATE TOOL GRINDERS
FACE MILL GRINDERS
DIE MAKING MACHINES

OLIVER INSTRUMENT CO.
1410 E. MAUMEE • ADRIAN, MICHIGAN

BURS
See Files and Burs, Rotary

BUSHINGS, Brass, Bronze, Carbide, Etc.
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Johnson Bronze Co., New Castle, Pa.
Kennametal, Inc., Latrobe, Pa.

BUSHINGS, Hardened
Colonial Bushings, Inc., 31780 Groesbeck Hwy., Fraser, Mich.
Danly Machine Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
U. S. Steel Co., Inc., 436 7th Ave., Pittsburgh, Pa.
U. S. Tool Co., Inc., 255 N. 18th St., Ampere, N. J.

BUSHINGS, Jig
Colonial Bushings, Inc., 31780 Groesbeck Hwy., Fraser, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Universal Engrg. Co., Frankenmuth, Mich.

CABINETS, Tool
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.

CALIPERS
Ames, B. C., & Co. (Dial), Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Millers Falls Co., Greenfield, Mass.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

CAM CUTTING MACHINES
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Fellows Gear Shaper Co., Springfield, Vt.
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Sunstrand Machine Tool Co., 2531 11th St., Rockford, Ill.

CAM MILLING AND GRINDING MACHINES
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Cincinnati Milling Machine Co., Oakley, Cincinnati, Ohio.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Landis Tool Co., Waynesboro, Pa.
Rowbottom Machine Co., Waterbury, Conn.

CAMS
Eisler Engrg. Co., Inc., 760 S. 13th, Newark 3, N. J.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Rowbottom Machine Co., Waterbury, Conn.

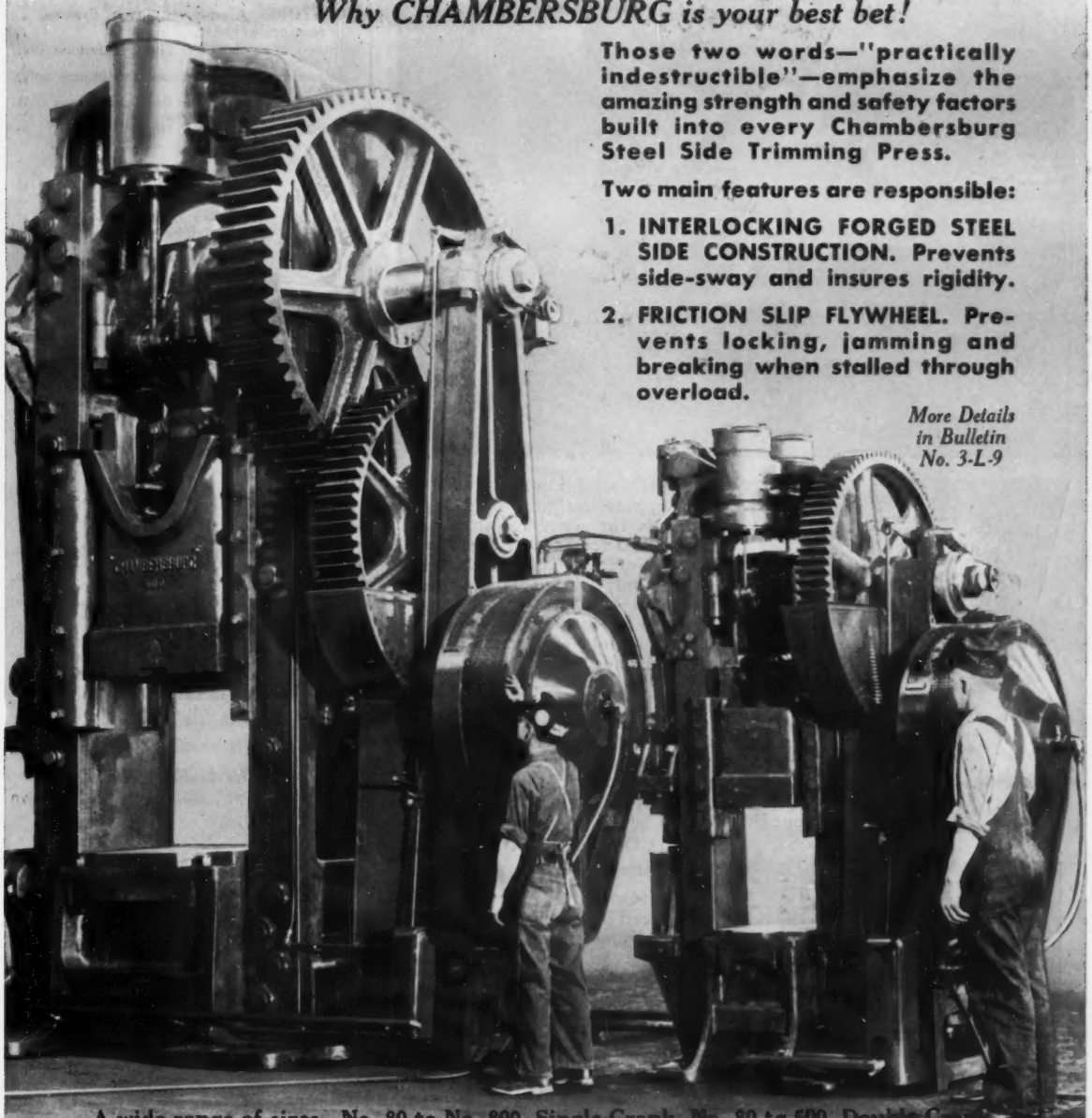
CARBIDES, TANTALUM, TITANIUM AND TUNGSTEN
Alleghany Ludlum Steel Corp., Pittsburgh, Pa.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Firth Sterling, Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Kennametal, Inc., Latrobe, Pa.
Metal Carbides Corp., Youngstown, Ohio.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Wesson Metal Corp., Lexington, Ky.
Willey's Carbide Tool Corp., 1340 W. Vernor Hwy., Detroit 1, Mich.

(*Continued on page* 312)

For more information on products advertised, use Inquiry Card, page 243

"PRACTICALLY INDESTRUCTIBLE"

Why CHAMBERSBURG is your best bet!



Those two words—"practically indestructible"—emphasize the amazing strength and safety factors built into every Chambersburg Steel Side Trimming Press.

Two main features are responsible:

1. **INTERLOCKING FORGED STEEL SIDE CONSTRUCTION. Prevents side-sway and insures rigidity.**
2. **FRICTION SLIP FLYWHEEL. Prevents locking, jamming and breaking when stalled through overload.**

More Details in Bulletin No. 3-L-9

A wide range of sizes—No. 80 to No. 800, Single Crank. No. 80 to 500, Double Crank.
Shown above are No. 500 and No. 80, Single Crank.

CHAMBERSBURG ENGINEERING COMPANY • CHAMBERSBURG • PENNSYLVANIA

CHAMBERSBURG

STEEL SIDE

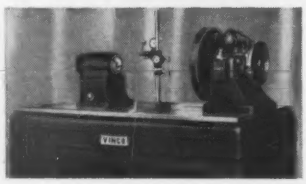
TRIMMING PRESSES



A Specialist is Your Best Bet

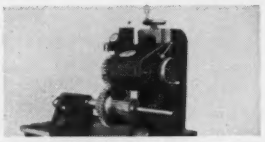
The A4D, a mighty midget atomic bomber, was designed by Douglas specialists for simplified mass production. This requires all operational parts to be interchangeable, which can be achieved only by critical dimensional control with the proper inspection equipment. The inspection equipment designed and built by Vinco specialists is considered the finest and most accurate of its kind in use today. It is being used in both large and small plants throughout the country for checking critical dimensions on cams, camshafts, gears, splines, etc. You, like many others, will find Vinco inspection equipment of real value in the production of interchangeable parts. Let us prove why "A specialist is your Best Bet."

VINCO CORPORATION
9113 Schaefer Hwy., Detroit 28, Mich.



The Vinco Optical Master Inspection Dividing Head is a "must" for accurately checking angular spacing. Accuracy is guaranteed to within two seconds of arc. Spindle run-out is guaranteed to be less than .000025". Write for complete data.

This universal gear rolling inspection fixture has versatility and wide size range. It provides a fast, accurate check of the concentricity, backlash, and smoothness of the rolling action of gears.



Spline gages, designed and made by Vinco specialists, assure splined parts dimensional control. Many manufacturers have our field engineers work with them on spline design, production and inspection, saving time and money. Why don't you?



Metal Component Parts Mass Produced • Aircraft and Commercial Gears • Model B-1 Dresser • Precisiondex • Spline Gages Master Gears • Gear Rolling Inspection Fixtures • Camshaft Comparators • Optical Master Inspection Dividing Heads • Involute Checker.

VINCO ®

MILLIONTHS OF AN INCH FOR SALE

TRADEMARK OF DEPENDABILITY

CASEHARDENING FURNACES
See Furnaces, Heat-Treating

CASTINGS, Aluminum, Brass, Bronze, Magnesium, Etc.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Bethlehem Steel Co. (Brass and Bronze only), Bethlehem, Pa.
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Mueller Brass Co., Port Huron 35, Mich.

CASTINGS, Die
American Brass Co., Waterbury 20, Conn.
Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.
Madison-Kipp Corp., Madison, Wisc.

CASTINGS, IRON
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Brown & Sharpe Mfg. Co., Providence, R. I.
Chambersburg Engineering Co., Chambersburg, Pa.
Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.
Link-Belt Co., 180 W. Duncannon Ave., Philadelphia 20, Pa.

CASTINGS, Steel, Alloys, Etc.
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Birdsboro Steel Fdry. & Mch. Co., Birdsboro, Pa.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Lebanon Steel Foundry, Dept. J, Lebanon, Pa.
Link-Belt Co., 180 W. Duncannon Ave., Philadelphia 20, Pa.
U. S. Steel Corp., Columbia Steel Co., Div., 436 7th Ave., Pittsburgh, Pa.

CEMENT, Disc Grinding Wheel
Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

CENTERING MACHINES
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Espen-Lucas Machine Works, Front St., and Girard Ave., Philadelphia, Pa.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Jones & Lamson Mch. Co., Springfield, Vt.
Millholland, W. K., Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Synder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sunstrand Machine Tool Co., 2531 11th St., Rockford, Ill.

CENTERS, Lathe
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Firth Sterling, Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Kennametal, Inc., Latrobe, Pa.
Metal Carbides Corp., Youngstown, Ohio.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd. Plymouth, Mich.

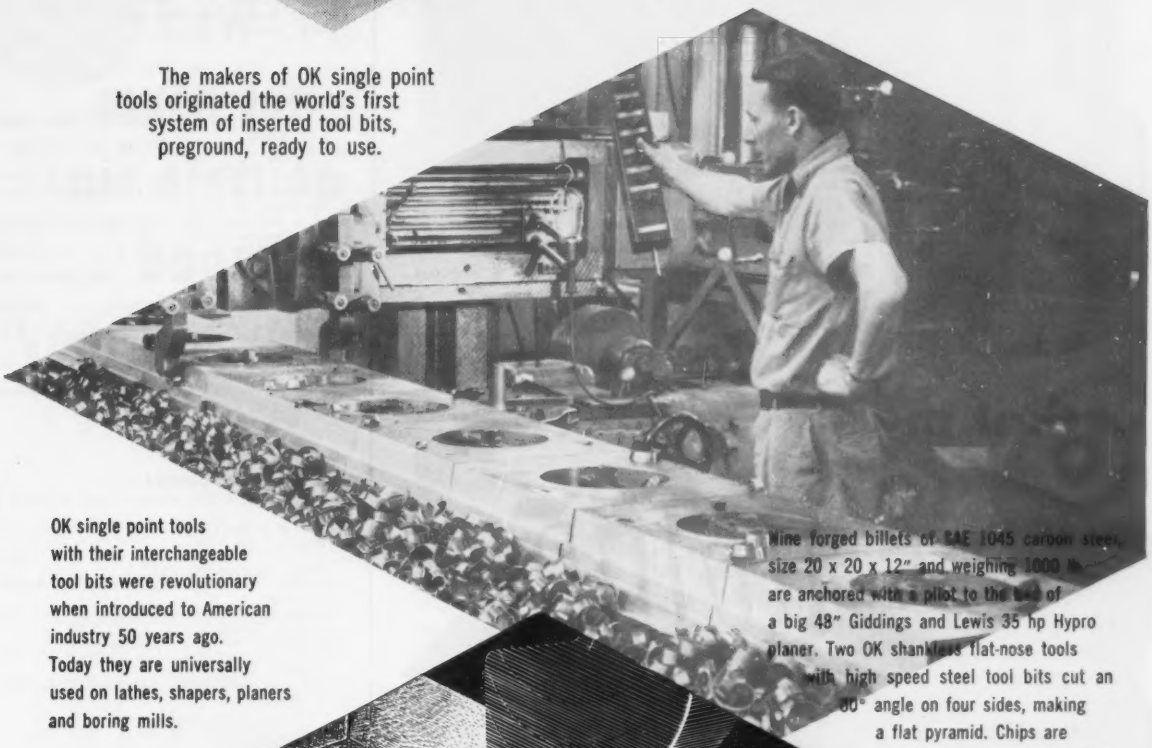
(*Continued on page* 314)

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How Bullard Man-au-trol turret heads are gang-planed with two

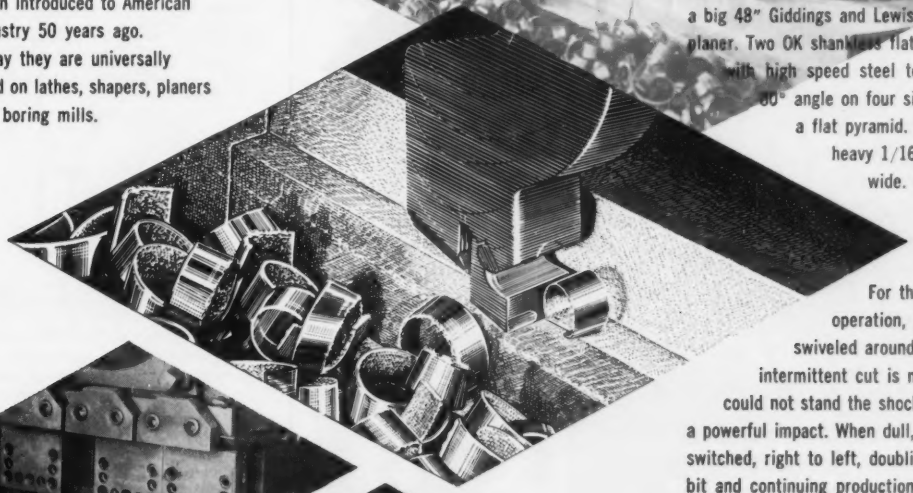
OK single point tools

The makers of OK single point tools originated the world's first system of inserted tool bits, preground, ready to use.



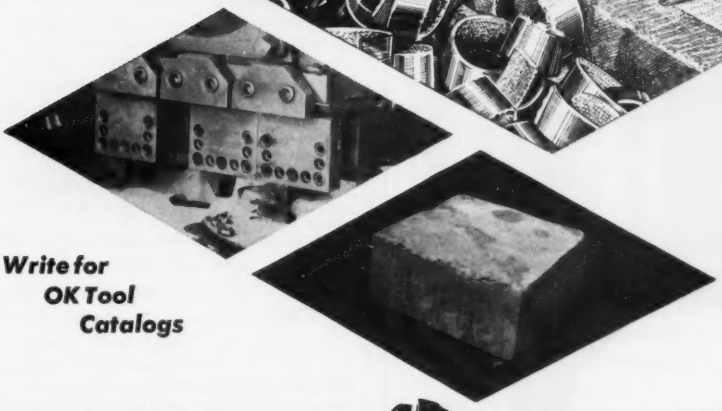
Nine forged billets of SAE 1045 carbon steel, size 20 x 20 x 12" and weighing 1000 lb. are anchored with a pilot to the bed of a big 48" Giddings and Lewis 35 hp Hypro planer. Two OK shankless flat-nose tools with high speed steel tool bits cut an 80° angle on four sides, making a flat pyramid. Chips are heavy 1/16" depth, 3/4" wide. Feed, 40 ft/m.

OK single point tools with their interchangeable tool bits were revolutionary when introduced to American industry 50 years ago. Today they are universally used on lathes, shapers, planers and boring mills.



For the second operation, the blocks are swiveled around and a rugged intermittent cut is made. Carbide could not stand the shock of such a powerful impact. When dull, tool bits are switched, right to left, doubling to life of the bit and continuing production with the minimum of downtime.

OK tools are built for heavy machining. Holders are tough forgings. For tool bits, you have a choice of high speed steel, cobalt, Vasco Supreme and carbide.



Write for OK Tool Catalogs

TWO COMPONENTS— BODY AND BLADES

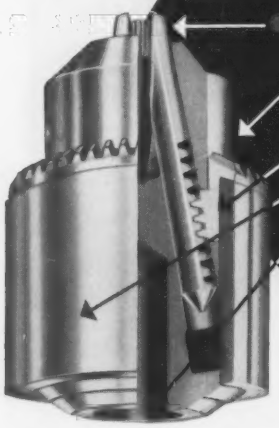


OK

modern milling cutters for modern milling machines

THE OK TOOL COMPANY, INC. Milford 6, New Hampshire

Here are the points...



Jaws Nickel Chrome Moly Alloy Steel

Key Holes: do not extend into body cavity thereby sealing out dirt

One Piece Geared Nut Construction

Entire Chuck Body Hardened inside and out

Taper Bore hardened and ground

Chucks and Keys interchangeable with other makes

...that make

Quality Supreme BRAND Chucks

Every chuck is individually checked for accuracy . . . you can depend on Supreme Chucks for trouble-free performance and long wear.



SUPREME PRODUCTS, INC.
2222 S. CALUMET AVE., CHICAGO, ILLINOIS

the chuck that lives up to its name . . . SUPREME

CHAINS, Power Transmission and Conveyor

Boston Gear Works, 3200 Main St., North Quincy, Mass.
Link-Belt Co., 220 S. Belmont Ave., Indianapolis 6, Ind.
Philadelphia Gear Works, Erie Ave., and G St., Philadelphia, Pa.

CHISELS AND CHISEL BLANKS

Bethlehem Steel Co., Bethlehem, Pa.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.

CHUCKING MACHINES

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Bardons & Oliver, Inc., Ft. W. 9th St., Cleveland 13, Ohio.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Goss & DeLeeuw Mch. Co. (Multiple Spindle), Kensington, Conn.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
National Acme Co., (Single and Multiple Spindle) 170 E. 131st St., Cleveland, Ohio.
Potter & Johnston Co., 1027 Newport Ave., Pawtucket, R. I.
Sunstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

CHUCKS, Air Operated

Cushman Chuck Co., Windsor Ave., Hartford 2, Conn.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Schrader' Son, A., 470 Vanderbilt Avenue, Brooklyn, N. Y.
Skinner Chuck Co., 344 Church St., New Britain, Conn.
Tomkins-Johnson Co., Jackson, Mich.
Whiton Machine Co., 190 Howard St., New London, Conn.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

CHUCKS, Collet or Split

See Collets

CHUCKS, Diaphragm

DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Gleason Works, 1000 University Ave., Rochester, N. Y.
Van Norman Co., 2640 Main St., Springfield 7, Mass.

CHUCKS, Drill

Ettco Tool Co., Inc., 592 Johnson Ave., Brooklyn, N. Y.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Jacobs Mfg. Co., West Hartford, Conn.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Skinner Chuck Co., 344 Church St., New Britain, Conn.
Supreme Products, Inc., 2222 So. Calumet, Chicago 16, Ill.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

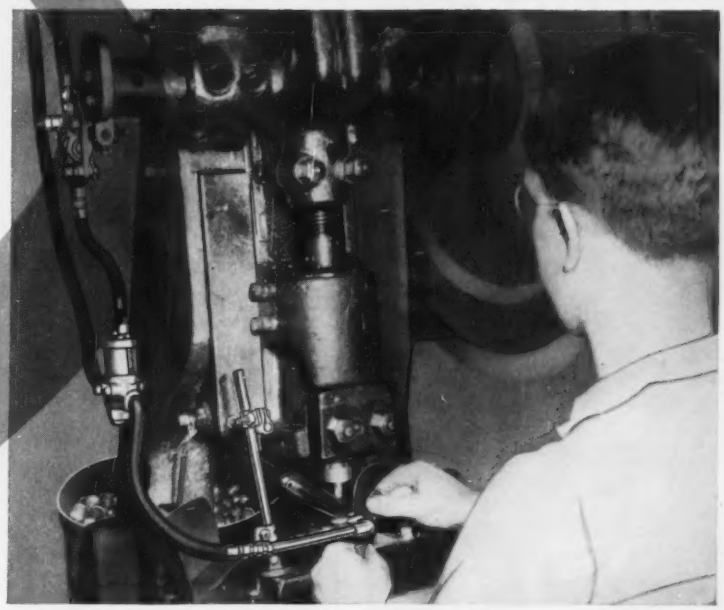
CHUCKS, Full Floating

Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, Staten Island, N. Y.
Gisholt Mch. Co., Madison 10, Wis.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Universal Engineering Co., Frankenmuth 2, Mich.

(*Continued on page* 316)

For more information on products advertised, use Inquiry Card, page 243

how much can air ejection boost your production

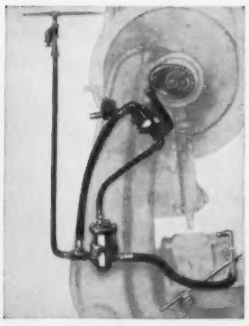


Actually, it can *double production.* With Schrader Air Ejection Sets on your presses, after each press cycle, there's a quick puff of air—automatically timed to do the job just right—and you're set for the next blank to be inserted.

No more tedious, dangerous hand removal!
No more wasteful steady air blasts!

Schrader Air Ejection Sets come in many types to suit any need. You can buy them for cam operation off the crankshaft, or for roller tripper actuation from the ram. If the parts you are fabricating are too heavy to be blown from the dies by an air blast, the Schrader Cylinder Knockout Set is available, which utilizes the knockout force available from a push-type Schrader Cylinder.

But regardless of the type of ejection set you need, you'll find one exactly suited to your requirements at Schrader. Schrader Air Ejection Sets come complete with all necessary fittings, valves, hose and air line accessories—all ready to be bolted to your press. Write today for full details.



This is the Schrader No. 3208W Air Ejection Set. Similar sets are available for cam or tripper operation, with or without pilot valve timing.

Schrader
REG. U. S. PAT. OFF.

leaders in air control

since 1844

Air Cylinders • Operating Valves • Press & Shear Controls • Air Ejection Sets • Blow Guns • Air Line Couplers • Air Hose & Fittings • Hose Reels • Pressure Regulators & Oilers • Air Strainers • Hydraulic Gauges • Uniflare Tube Fittings

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A. SCHRADER'S SON
Division of Scovill Manufacturing Company, Incorporated
454 Vanderbilt Avenue, Brooklyn 17, N. Y., Dept. T-2

I am interested in more information on.....

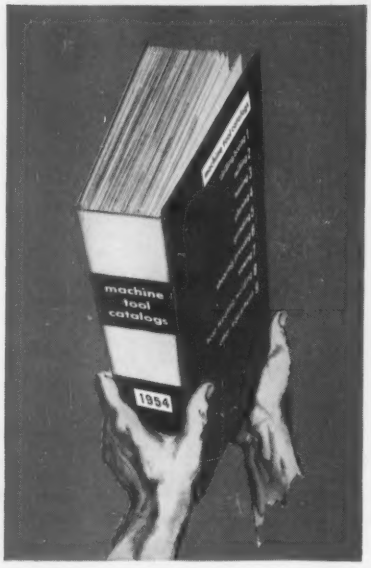
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Company_____

Address_____

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grinding equipment?

reach for Machine Tool Catalogs



"... a great time-saver"

These manufacturers' catalogs are instantly available in Section 5 of your Machine Tool Catalogs:

Abrasive Machine Tool Co.	Heald Machine Company
Arter Grinding Machine Company	Landis Tool Company
Besly-Welles Corporation	Micromatic Hone Corp.
Boyer-Schultz Corp.	Norton Company
Bryant Chucking Grinder Company	Oliver Instrument Co.
Crane Packing Company	Reid Bros. Company
	Sheffield Corporation
	Taft-Peirce Mfg. Co.

***ALSO:* The following catalogs, in other sections of your Machine Tool Catalogs, contain information on grinding equipment:**

Brown & Sharpe Mfg. Co.	Kearney & Trecker Corp.
Cincinnati Milling Machine Co.	LeBlond, R. K., Machine Tool Co.
Consolidated Machine Tool Corp.	Ohio Machine Tool Co.
Dake Engine Co.	Osborn Mfg. Co.
Gisholt Machine Co.	Rivett Lathe & Grinder, Inc.
Gleason Works	Rowbottom Machine Co.
Greenlee Bros. & Co.	Sundstrand Machine Tool Co.
Hall Planetary Co.	Torit Mfg. Co.
Jones & Lamson Machine Co.	Wales-Strippit Corp.

In other sections of the File you will find additional catalogs containing useful information on a wide range of machine tools and accessories.

Sweet's Catalog Service

Division of
F. W. Dodge Corporation
119 West 40th Street, New York 18, N. Y.

CHUCKS, Gear

Gleason Works, 1000 University Ave., Rochester, N. Y.
Horton Chuck, Windsor Locks, Conn.
Supreme Products, Inc., 2222 So. Calumet, Chicago 16, Ill.

CHUCKS, Lathes, etc.

Buck Tool Co., 220 Schippers La., Kalamazoo, Mich.
Bullard Co. Brewster St., Bridgeport 2, Conn.
Cushman Chuck Co., Windsor Ave., Hartford 2, Conn.
Gisholt Mch. Co., Madison 10, Wis.
Horton Chuck, Windsor Locks, Conn.
Jacobs Mfg. Co., West Hartford, Conn.
Jones & Lamson Mch. Co., Springfield, Vt.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Skinner Chuck Co., 344 Church St., New Britain, Conn.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.
Whiton Machine Co., 190 Howard St., New London, Conn.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

CHUCKS, Magnetic

Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Hanchett Magna-Lock Corp., Big Rapids, Mich.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Walker, O. S., Co., Inc., Worcester, Mass.

CHUCKS, Power Operated

Skinner Chuck Co., 344 Church St., New Britain, Conn.

CHUCKS, Quick Change and Safety

Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, S. I., N. Y.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.
Procunier Safety Chuck Co., 18 S. Clinton St., Chicago, Ill.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Universal Engineering Co., Frankenmuth 2, Mich.

CHUCKS, Ring Wheel

Gardener Mch. Co., Div. Landis Tool Co., 414 E. Gardner St., Beloit, Wis.

CHUCKS, Tapping

DoAll Co., 254 N. Laurel Ave., Des Plaines. Ill.
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, S. I., N. Y.
Jacobs Mfg. Co., West Hartford, Conn.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Procunier Safety Chuck Co., 18 S. Clinton St., Chicago, Ill.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Skinner Chuck Co., 344 Church St., New Britain, Conn.

CIRCUIT-BREAKERS

General Electric Co., Schenectady 5, N. Y.

CLAMPS

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Danly Mch. Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Mead Specialties Co., 4114 N. Knox Ave., Chicago 41, Ill.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Starrett, The L. S., Co., Athol, Mass.
Williams, J. H. & Co., 400 Vulcan St. Buffalo 7, N. Y.

CLEANERS, Chemical, for Metal

Bullard Co., Bullard-Dunn Process Div., Brewster St., Bridgeport 2, Conn.
Oakite Products, Inc., 19 Rector St., New York N. Y.

CLUTCHES

Clearing Mch. Corp., 6499 W. 65th St., Chicago 38, Ill.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Formsprag Co., 23609 Hoover Rd., Van Dyke, Mich.
Link-Belt Co., 300 West Pershing Rd., Chicago 9, Ill.
Lipe-Rollway Corp., 806 Emerson Ave., Syracuse, N. Y.
Rockford Clutch Div., Borg-Warner Corp., 410 Catherine St., Rockford, Ill.
Twin Disc Clutch Co., 1361 Racine St., Racine Wis.

COLLARS, Safety

Link-Belt Co., 220 S. Belmont Ave., Indianapolis 6, Ind.
Standard Pressed Steel Co., Jenkintown, Pa.

COLLETS

Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Machine Co., Oakley, Cincinnati, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Gisholt Mch. Co., 1245 E. Washington Ave., Madison 10, Wis.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Hardinge Bros., Inc., 1418 College Ave., Elmira, N. Y.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Pratt & Whitney, West Hartford 1, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Tomkins-Johnson Co., Jackson, Mich.
Union Twist Drill Co., Athol, Mass.
Universal Engrg. Co., Frankenmuth 2, Mich.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

COMPARATORS

See Gages, Comparator.

COMPARATORS, Optical

DoAll Co., 254 Laural Ave., Des Plaines, Ill.
Eastman Kodak Co., Rochester, N. Y.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Jones & Lamson Mch. Co., Springfield, Vt.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

COMPOUNDS, Cleaning

Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Oakite Products, Inc., 19 Rector St., New York.

COMPOUNDS, Cutting, Grinding, Metal Drawing, Etc.

Cities Service Oil Co., 70 Pine St., New York, N. Y.
Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich. (Broaching & Lopping).
Oakite Products, Inc., 19 Rector St., New York, N. Y.
Shear-Speed Chem. Prod. Div., Michigan Tool Co., 7125 E. McNichols Rd., Detroit 12, Mich.
Sinclair Refining Co., 600 Fifth Ave., New York.
Standard Oil Co. (Indiana), 910 S. Michigan, Chicago, Ill.
Stuart, D. A., Oil Co., Ltd., 2739 S. Troy St., Chicago 23, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia, Pa.
Texas Co., 135 E. 42nd St., New York, N. Y.

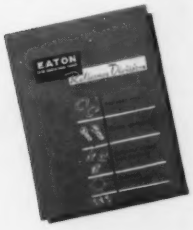
(*Continued on page 320*)

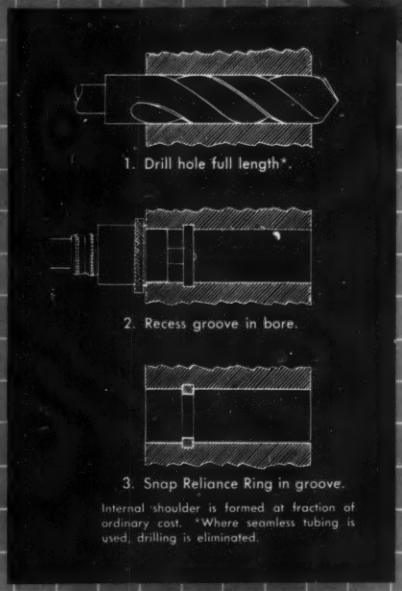
Reliance

SNAP RINGS Save Man Hours Money and Material

Now it's easy to position gears and bearings on shafts without resorting to countless hours of intricate and expensive machining operations. Nor do you sacrifice quality when you let Reliance Snap Rings do the same job on shaft assemblies, bearing applications and counterbores that formerly required many man hours and wasted materials.

Reliance Snap Rings form a solid shoulder able to withstand predetermined thrust loads simply by machining a groove into a shaft and snapping in a Reliance Ring. Compare this to the waste in time and materials of machining the entire length of the shaft to form a shoulder. Wherever it is practical from a design standpoint, Reliance engineers can show you how to save man hours, money and material by switching from expensive machining operations to Reliance Snap Rings. You will find more detailed information in our Engineering Folder 4K/3 which we will be happy to send at your request with no obligation.





RELIANCE DIVISION EATON® MANUFACTURING COMPANY

OFFICE and PLANTS: 507 Charles Ave., S. E. MASSILLON, OHIO

Springtites & Sems · Snap & Retaining Rings · Special Steels · Spring Lock Washers · Hos-Fas-Ner

SALES OFFICES: New York • Cleveland • Detroit • Chicago • St. Louis • San Francisco • Montreal

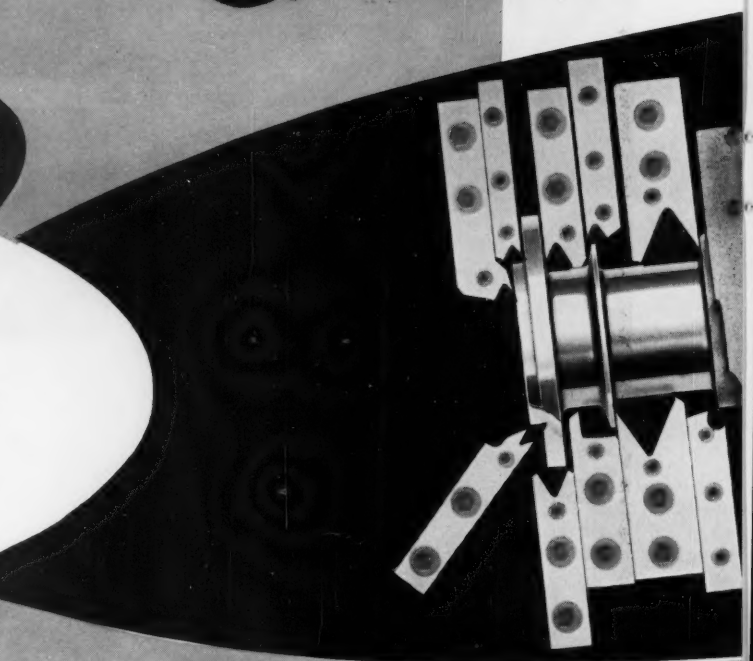
"SPRINGTITE" AND "HOS-FAS-NER" ARE REGISTERED TRADEMARKS OF THE EATON MANUFACTURING COMPANY

WESSONMETAL
Carbide Blanks

WESSON
Carbide Cutting Tools
ENGINEERED FOR CARBIDE

WICKES

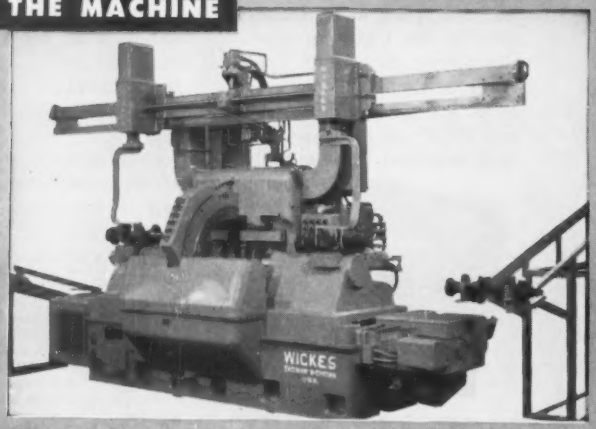
COMBINED SKILLS



WORKING TOGETHER FOR THE BENEFIT OF ALL TO CREATE . . .

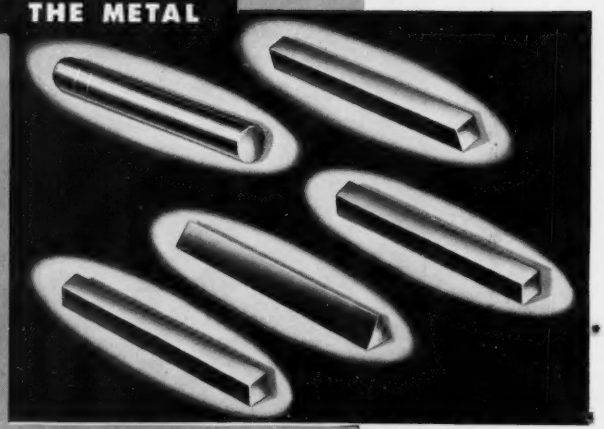
- More Productive Tools
- More Productive Machine Tools
- More Uniform Quality Carbide
- Lower Costs

THE MACHINE



Wickes lathes used on this tough operation are the result of engineering-design experience gained from many years of solving hundreds of specific machine tool problems.

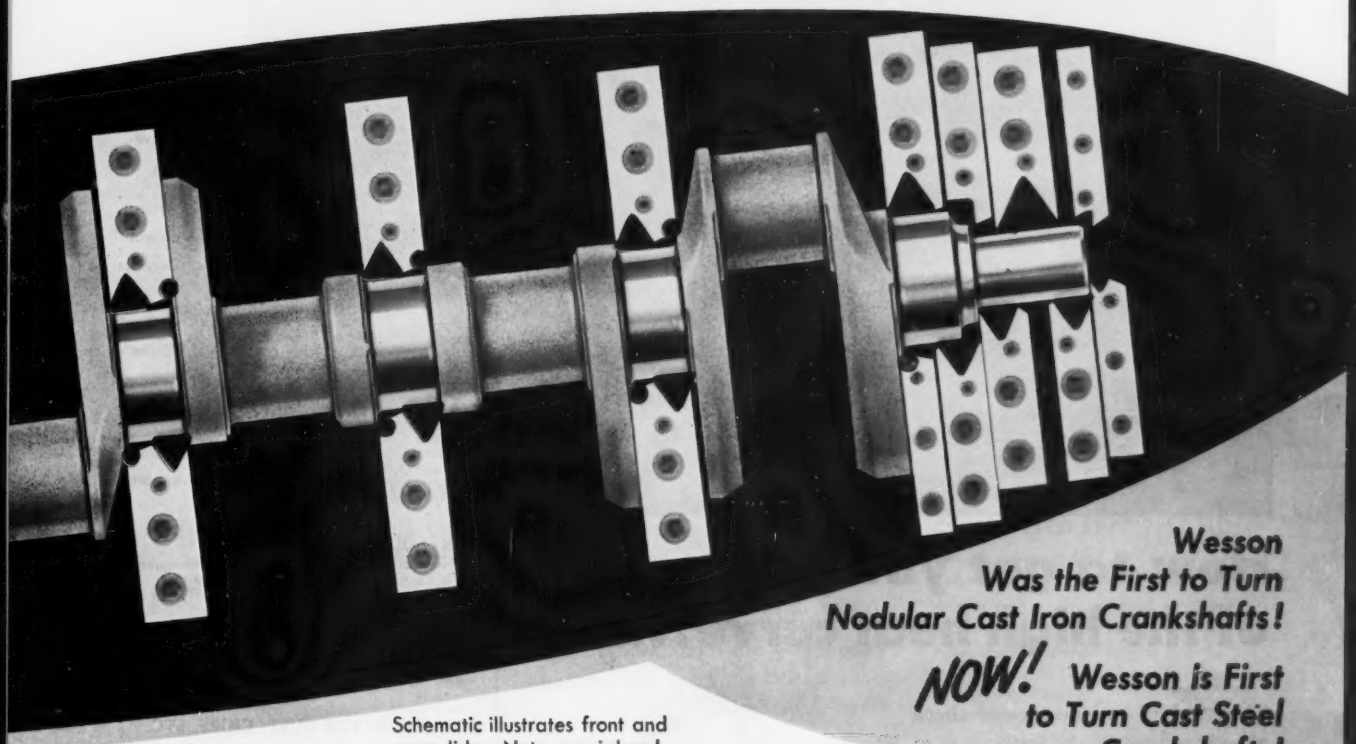
THE METAL



Wessonmetal uniformity of grade is the key to outstanding performance in single and multiple insert set-ups on all types of material. Every Wessonmetal insert or batch of inserts is engineered to out produce on every type of operation. Wessonmetal uniformity is the result of unique and exacting quality control.

WESSON METAL CORPORATION
LEXINGTON, KENTUCKY

FIRST TO TURN CAST STEEL CRANKSHAFTS!



Wesson Was the First to Turn Nodular Cast Iron Crankshafts!

NOW! Wesson is First to Turn Cast Steel Crankshafts!

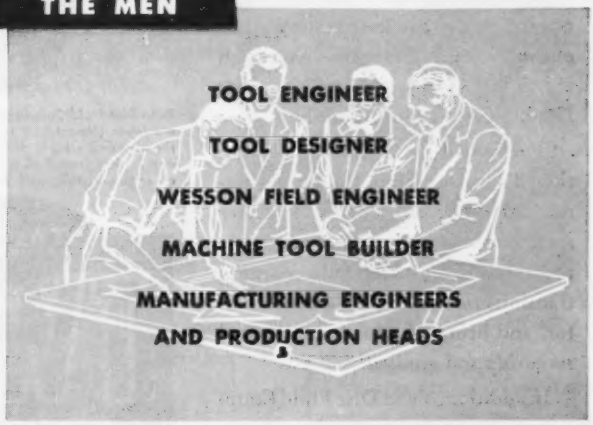
Schematic illustrates front and rear slides. Note special multiple tool adaptations possible *only* with Band-Type Multicuts!

THE TOOLS



Wesson Multicut Band-Type Tool Holders are tailor-made for single and multiple tool set-ups. Exclusive features include "built-in flush gage" for quick, accurate insert set-up" in the machine; low cost steel band is replaceable, insert removal slot permits fast and easy insert removal. The body is practically indestructible! Available in over 100 standard sizes—11 styles!

THE MEN

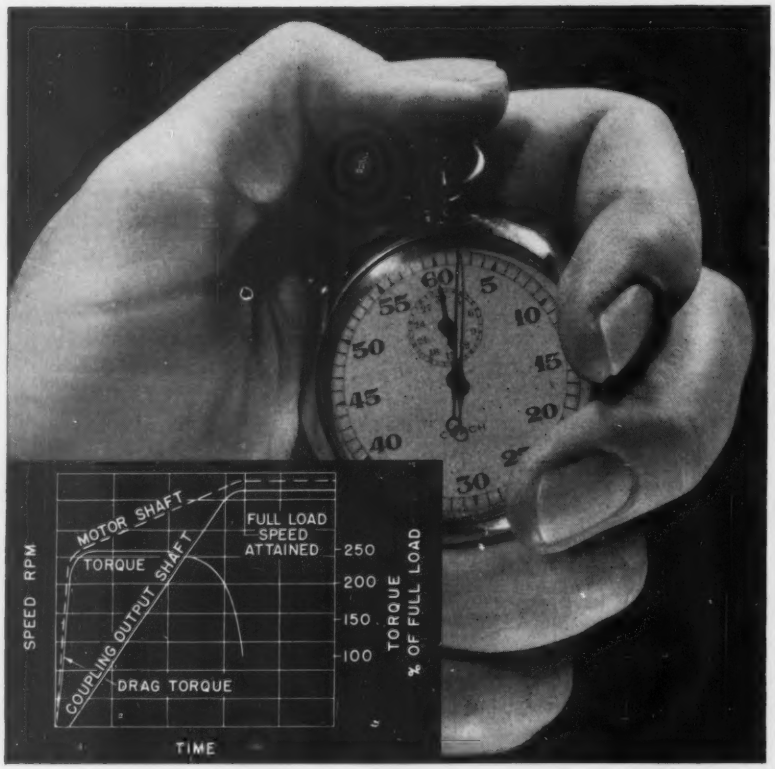


Credit lines above are typical of Wesson's thorough approach to "tough" tooling problems." Working together with the metallurgist, the Tool Engineer, Machine Tool Builder, and the customer, Wesson Field Engineers combine skill and experience in the solution of big jobs like the steel crank and single point tool applications in small production runs!

WESSON COMPANY

1220 WOODWARD HEIGHTS BLVD., FERNDALE 20, MICHIGAN

WESSON METAL CORPORATION
LEXINGTON, KENTUCKY



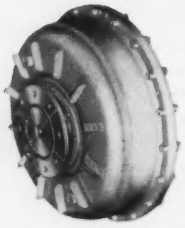
How to get your motors out of the high heat curve... *fast*

Thousands of equipment owners have already proved it: the fastest way to get a normal induction type motor "out from under the load" and up to normal rpm—and keep it there without shocks and vibrations—is through the fluid "slip" within a Twin Disc Double-Circuit Fluid Coupling.

By *eliminating* mechanical connection, Twin Disc Fluid Couplings permit *full acceleration of motor under load within a few seconds* . . . while the output shaft of the fluid coupling transmits *full* input torque of the motor, and brings the load up to speed *smoothly* and *gradually*.

In addition, Twin Disc Fluid Couplings offer such advanced performance features as *Double-Circuit design* . . . making them the *most efficient fluid drives available today*.

Write Twin Disc—Dept. DS, Racine, Wisc.—for *complete* information! Ask for Bulletin 144-D.



Twin Disc Fluid Couplings are available in 9 different types (Model 12.2 HCB Coupling shown), with the broadest variety of input, output combinations, and in sizes from 7.4S to 27 to accommodate motor- or engine-installations from fractional to 850 hp.

TWIN DISC
CLUTCHES AND HYDRAULIC DRIVES
TWIN DISC

TWIN DISC CLUTCH COMPANY, Racine, Wisconsin
Hydraulic Division, Rockford, Illinois

COMPOUNDS, Resin and Moulding
General Electric Co., Schenectady 5, N. Y.

COMPRESSORS, Air
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.

CONTOUR FOLLOWER
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Turchan Follower Machine Co., 8259 Livernois and Alaska Aves., Detroit, Mich.

CONTRACT WORK
Blanchard Mch. Co., 64 State St., Cambridge, Mass.
Columbus Die-Tool & Mch. Co., 955 Cleveland Ave., Columbus, Ohio.
Diefendorf Gear Corp., 920 N. Belden Ave., Syracuse, N. Y.
Eisler Engrg. Co., 760 S. 13th, Newark 3, N. J.
Fellows Gear Shaper Co., Springfield, Vt.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland, Ohio.
Minster Machine Co., Minster, Ohio.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Mummert-Dixon Co., Hanover, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Rockford Mch. Tool Co., 250 Kishwaukee St., Rockford, Ill.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.
Wicaco Machine Corp., Stenton Ave. and Louden St., Philadelphia, Pa.

CONTROLLERS
Allen-Bradley Co., 1326 S. 2nd St., Milwaukee.
Clark Controller Co., Cleveland, Ohio.
General Electric Co., Schenectady 5, N. Y.

CONTROLS, Thermo
Control Products, Inc., 306 Sussex St., Harrison, N. J.

CONVEYORS FOR DUST, CHIPS, ETC.
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Link-Belt Co., 300 W. Pershing Rd., Chicago 9.

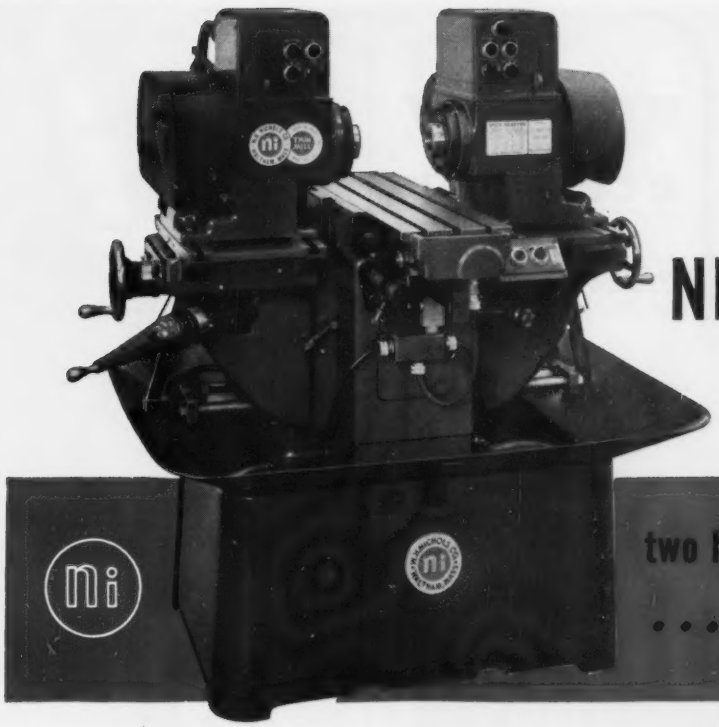
COOLANT SEPARATORS
See Separators, Oil or Coolant.

COUNTERBORES
Allen Mfg. Co., 133 Sheldon St., Hartford 2, Conn.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling, Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Gorham Tool Co., 14400 Woodrow Wison, Detroit, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Kennametal, Inc., Latrobe, Pa.
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.
National Twist Drill & Tool Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Starrett, The L. S., Co., Athol, Mass.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

(*Continued on page* 322)

For more information on products advertised, use Inquiry Card, page 243

WESSON COMPANY
1220 WOODWARD HEIGHTS BLVD., FERNDALE 20, MICHIGAN



NICHOLS TWIN MILL

two heads are better than one
....for sure!

The Nichols Twin Mill is something new in duplex millers — a precision 2-spindle bed-type miller designed for simultaneous light duty milling of opposite or adjacent surfaces, using **horizontal or vertical spindles.**

The Twin Mill provides unmatched flexibility! It is equally adaptable for long-run or short-run jobs. The two geared milling heads are independent units, with separate 1 HP motor drives, and are quickly adjusted either directly opposed or offset longitudinally, vertically or transversely. Set-up is fast and simple.

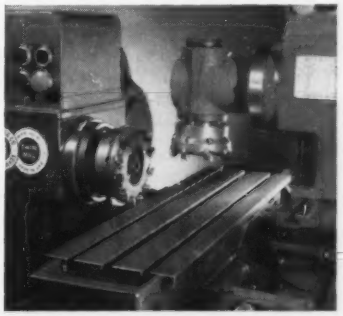
The wide range of spindle speeds from 55 to 2050 R.P.M. allows milling of ferrous or non-ferrous materials with high speed or carbide tipped cutters, producing EXTRA FINE FINISH while maintaining the closest tolerances with ease.

The Twin Mill is completely push-button controlled, arranged for automatic table cycling — with rapid approach, hydraulically controlled variable cutting feed and rapid return. Available with automatic retraction of milling heads, automatic spindle brakes and carefully engineered special features to meet specific applications.

The parts shown are typical of those on which the Twin Mill is cutting costs and boosting production. Investigate the savings it can make for you. For details write to Nichols-Morris Corporation.

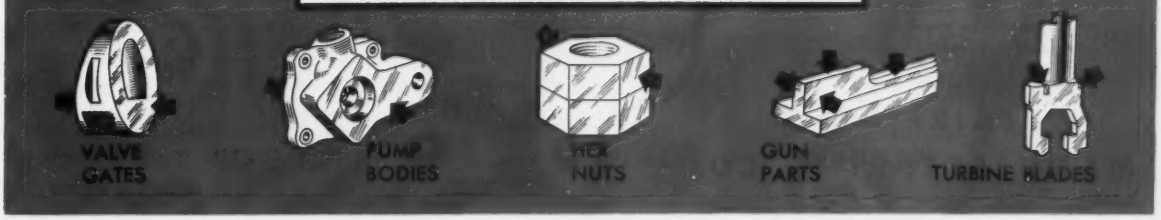
CONDENSED SPECIFICATIONS

Table, working surface	8⅝" x 30"
Table Travel—cutting stroke	11¾"
Motors	(two) 1 HP
Spindle Speeds (15)	from 55 to 2050 RPM
Max. height center of spindle above table	11¾"
Max. offset of spindles (horizontal)	8½"
Max. distance between spindle noses (across table)	16"
Floor space required	64" x 56"



Manufactured by W. H. Nichols Company, 48 Woerd Avenue, Waltham 54, Mass.

76-E Mamaroneck Ave. NATIONAL DISTRIBUTORS **NICHOLS-MORRIS CORPORATION** **White Plains, New York**



● This picture shows a part of Fairfield's Spur Gear Cutting Department where finest, new equipment is used to produce gears up to 1½ pitch, 36″ dia.



accuracy
economy
capacity

GEARS
by Fairfield

AT FAIRFIELD, you get the benefit of mass production ECONOMY, combined with every modern facility for manufacturing FINE GEARS!

Here "under one roof" is everything needed to meet your most exacting gear requirements — metallurgical department, batteries of the most modern machines, testing laboratories, complete heat-treating facilities — all operated by skilled craftsmen working under expert engineering supervision.

Get acquainted with the Manufacturing Service Fairfield offers to makers of agricultural implements, road building machinery, machine tools, engines, trucks, tractors, and all kinds of powered equipment. ***Your inquiry will receive prompt attention — ask for interesting, illustrated bulletin.***

FAIRFIELD MANUFACTURING CO.

2309 South Concord Road • Lafayette, Indiana

FINE GEARS
MADE TO ORDER

SPUR GEARS — Straight, helical, and internal. Sizes from 16 pitch, 1½″ dia., to 1½ pitch, 36″ dia.

HERRINGBONE—(*Fellows Type*). Sizes from 1½″ to 15″.

SPIRAL BEVEL — Sizes from 16 pitch, 1½″ dia., to 1½ pitch, 28″ dia.

STRAIGHT BEVEL—Sizes from 16 pitch, 1½″ dia., to 1½ pitch, 28″ dia.

HYPOID—Sizes from 1½″ to 28″ dia.

ZEROL — Sizes from 16 pitch, 1½″ dia., to 1½ pitch, 21″ dia.

WORMS AND WORM GEARS—Worms to 7″ dia. Worm gears to 36″ dia.

SPLINED SHAFTS — Lengths to 52″. Diameters from 1″ to 6″.

DIFFERENTIALS — 10,000 to 300,000 inch pounds capacity.

Note: All of the sizes above are approximate.



COUNTERSHAFTS
Standard Pressed Steel Co., Jenkintown, Pa.

COUNTERSINKS
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 120 Oakman Blvd., Detroit 32, Mich.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Greenfield Tap & Die Corp., Greenfield, Mass.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
National Twist Drill & Tool Co., Rochester, Mich.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Union Twist Drill Co., Athol, Mass.

COUNTERS, Revolution
Brown & Sharpe Mfg. Co., Providence, R. I.
Millers Falls Co., Greenfield, Mass.
Starrett, The L. S. Co., Athol, Mass.

COUNTING DEVICES
Starrett, The L. S. Co., Athol, Mass.

COUPLINGS, Flexible
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Cone-Drive Gear Div., Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Link-Belt Co., 220 S. Belmont Ave., Indianapolis 6, Ind.
Philadelphia Gear Works, Erie Ave., and G St., Philadelphia, Pa.
Sier-Bath Gear & Pump Co., Inc., 9248 Hudson Blvd., North Bergen, N. J.

COUPLINGS, Shaft
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Cone-Drive Gear Div., Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Link-Belt Co., 2045 W. Huntington Park Ave., Philadelphia 40, Pa.
Sier-Bath & Pump Co., Inc., 9248 Hudson Blvd., North Bergen, N. J.
Standard Pressed Steel Co., Jenkintown, Pa.

CRANES, Electric Traveling
Cleveland Crane & Engrg. Co., Wickliffe, Ohio.
Morgan Engrg. Co., Alliance, Ohio.

CUTTER GRINDERS
See Grinding Machines, for Sharpening Cutters, Reamers, Hobs, Etc.

CUTTERS, Gear
Brown & Sharpe Mfg. Co., Providence, R. I.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 6, Mich.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Hanson-Whitney Co., Div., Whitney Chain Co., Hartford, Conn.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich. (Shaving).
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.
National Twist Drill & Tl. Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Union Twist Drill Co., Athol, Mass.
Waltham Mch. Wks., Newton St., Waltham, Mass.
Wessen Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

(*Continued on page* 324)

For more information on products advertised, use Inquiry Card, page 243

WEJ-LOK

a new and different tool holder

of rugged design, simple to use,

positive locking and

universal application



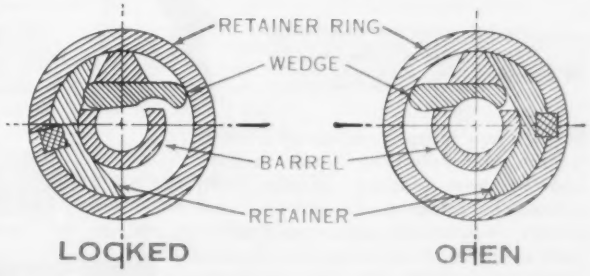
A simple hand spinning of the Wej-Lok retainer ring locks or unlocks inserted tools. Yet, either left or right-hand cutting tools are firmly held by this accurately machined tool holder.

In locked position, the flat surface of holder wedge is tightly seated in mating notched section of tool shank. Normal operating torque tends to further tighten this wedging action, thus, preventing all possibility of tool play or wobble. Where unusually large tools or extra heavy cutting operations are required, provision is made on the holder for use of a Baker drive to augment wedge locking and assure utmost stability.

Wej-Lok tool holder permits universal usage . . . grinding a simple flat area on any tool shank to match holder wedge provides positive locking. You will find Wej-Lok superior in every respect on all drilling, reaming, boring and milling operations.

Note these unusual Wej-Lok features:

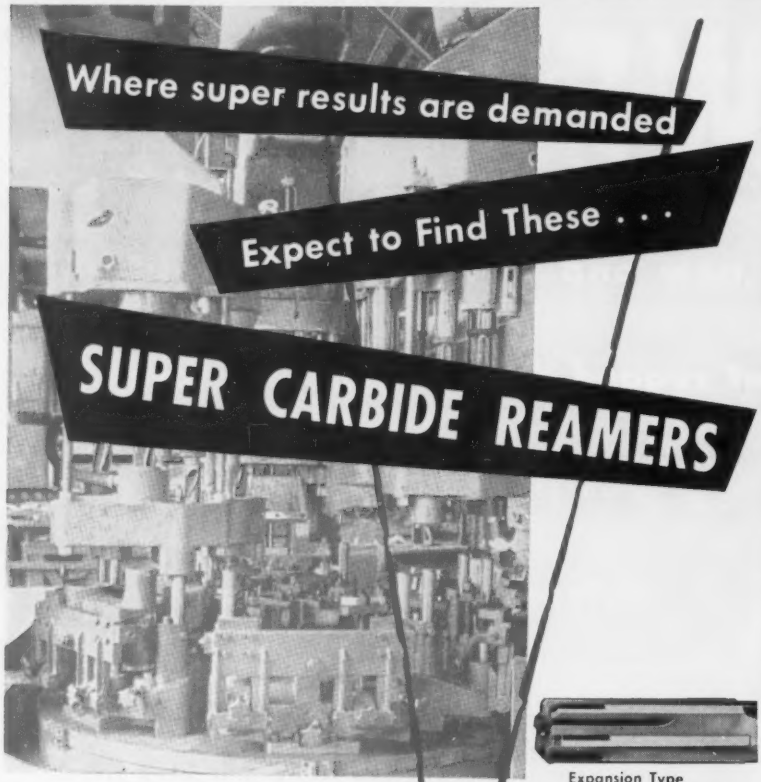
1. Shank and barrel machined from one piece.
2. Accurately machined to exacting tolerances.
3. Finest quality hardened steel used in all parts.
4. Long-life through elimination of wear areas.
5. Positive wedge type locking of tools.
6. Wedge lock plus Baker drive on larger tools.
7. Simple insertion and removal of tools.
8. Can be used for right or left-hand cutting tools.
9. All tools quickly ground for use in holder.
10. Designed for standard straight shank end mills.



DETROIT REAMER & TOOL CO.

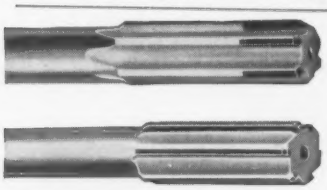
2830 EAST SEVEN MILE ROAD • DETROIT 34, MICHIGAN

D R & T COMPANY



Super Tool has always been proud to offer the most complete standard line of carbide tipped and solid carbide reamers in the industry—all types and complete range of sizes stocked for your convenience.

NOW
A NEW CUSTOMER SERVICE
SEMI-FINISHED REAMERS



Expansion Type
RH & LH Spiral
Jobbers Type
Shell Type
Solid Carbide
Flute-Long Tip
Regular Tip

Stocked in a complete range of sizes in regular and flute-long types, in both straight and tapered shanks with allowable grinding stock. You can grind to required diameter specification with a minimum of delay. No need to worry over emergency break-downs or short run jobs. Simply maintain your own stock of selected nominal sizes. Ask for this new listing with substantially reduced prices and place your requirements now.

Super TOOL COMPANY

21650 Hoover Rd., Detroit 13, Michigan • 5210 San Fernando Rd., Glendale 3, California

CUTTERS, Keyseater

Davis Keyseater Co., 405 Exchange St., Rochester 8, N. Y.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Keo Cutters, 19326 Woodward, Detroit, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

CUTTERS, Milling

Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Barber-Colman Co., Rock St., Rockford, Ill.
Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429 Royal Oak, Mich.
Brown & Sharpe Mfg. Co., Providence, R. I.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Detroit Tap & Tool Co., 8615 E. 8 Mile Rd., Base Line, Mich. (Thread)
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Gorham Tool Co., 1440 Woodrow Wilson, Detroit, Mich.
Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
Hanson-Whitney Co., Div., Whitney Chain Co., Hartford, Conn.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Kennametal, Inc., Latrobe, Pa.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.
National Twist Drill & Tl. Co., Rochester, Mich.
OK Tool Co., Milford, N. H.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.
Pratt & Whitney, West Hartford 1, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Tomkins-Johnson Co., Jackson, Mich.
Union Twist Co., Athol, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Willey's Carbide Tool Co., 1340 W. Verner Hwy., Detroit 1, Mich.

CUTTERS, Rotary

See Files & Burs, Rotary

CUTTING COMPOUNDS

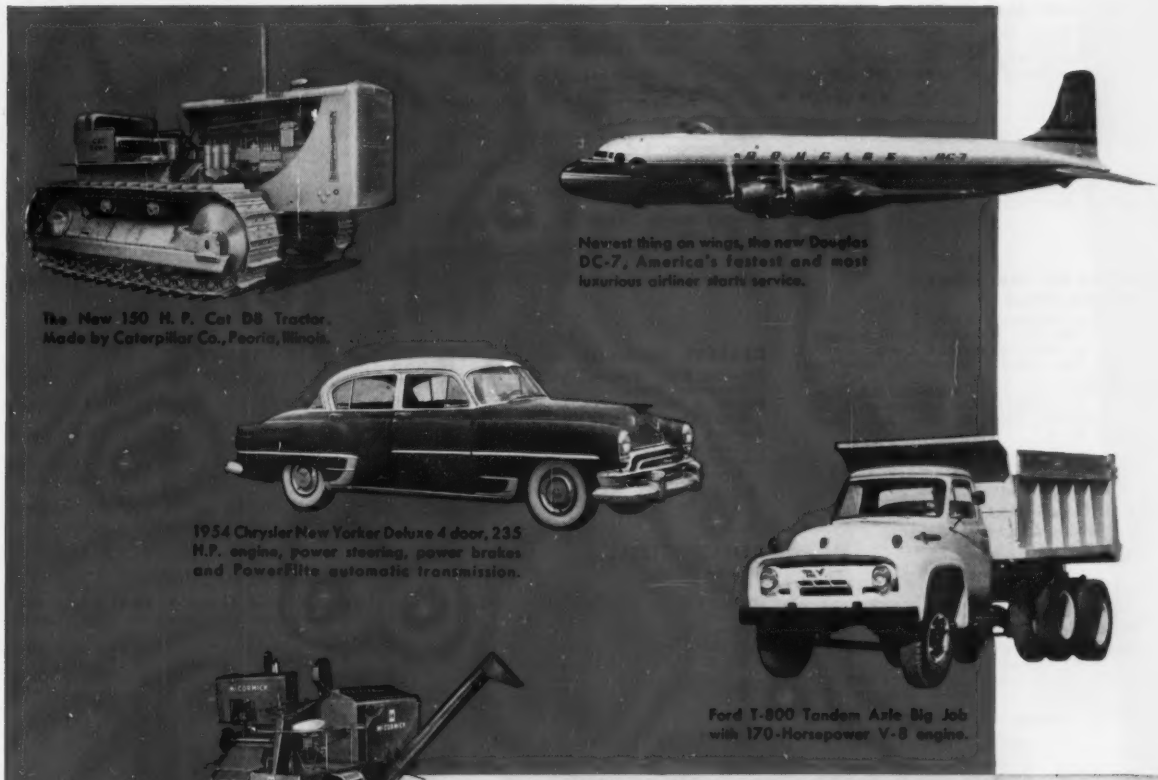
See Compounds, Cutting, Grinding, Etc.

CUTTING AND GRINDING FLUIDS

Cincinnati Milling Products Div., Cincinnati Milling Machine Co., Cincinnati, Ohio.
Cimcool Div., Cincinnati Milling Mch. Co., Cincinnati, Ohio.
Cities Service Oil Co., 70 Pine St., New York, N. Y.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Master Chemical Corp., 13 Huron St., Toledo 1, Ohio.
Shear-Speed Chemical Products, Div. Michigan Tool Co., 7125 E. McNichols Rd., Detroit 12, Mich.
Sinclair Refining Co., 600 Fifth Ave., New York.
Standard Oil Co. (Indiana), 910 S. Michigan, Chicago, Ill.
Stuart, D. A., Oil Co., Ltd., 2739 S. Troy St., Chicago 23, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia, Pa.
Texas Co., 135 E. 42nd St., New York, N. Y.

(*Continued on page 326*)

For more information on products advertised, use Inquiry Card, page 243



The New 150 H. P. Cat D8 Tractor. Made by Caterpillar Co., Peoria, Illinois.

Newest thing on wings, the new Douglas DC-7, America's fastest and most luxurious airliner starts service.

1954 Chrysler New Yorker Deluxe 4 door, 235 H.P. engine, power steering, power brakes and PowerFlite automatic transmission.

Ford T-800 Tandem Axle Big Job with 170-Horsepower V-8 engine.

International Harvester's New McCormick 141 Self-Propelled Harvester-Thresher

Quality FELT

HELPS PROTECT PERFORMANCE

Modern automotive equipment—airplanes, cars, trucks, tractors, Diesel and marine engines, motorcycles—use felt to protect many vital parts. This versatile and essential industrial material serves to seal out dust, dirt, water, seal in lubricants. Many ball bearings have felt seals which enable the bearing to serve reliably for a lifetime with the lubricant originally installed. Other uses of felt include sound and thermal insulation, vibration control, weather stripping, window channels, lubrication wicks . . . American supplies felt in sheets, strips, wicking, and in parts cut precisely to your blueprints, ready to install. There are many types of felt; for maximum satisfaction, consult American for confidential collaboration on designs and specifications for your various applications. Write on your company letterhead for S.A.E. Felt Standards, including samples and specifications.

American Felt Company

TRADE MARK

GENERAL OFFICES: 68 GLENVILLE ROAD, GLENVILLE, CONN.

SALES OFFICES: New York, Boston, Chicago, Detroit, Cleveland, Rochester, Philadelphia, St. Louis, Atlanta, Dallas, San Francisco, Los Angeles, Portland, Seattle, Montreal. PLANTS: Glenville, Conn.; Franklin, Mass.; Newburgh, N. Y.; Detroit, Mich.; Westerly, R. I.

ENGINEERING AND RESEARCH LABORATORIES: Glenville, Conn.

For more information on products advertised, use Inquiry Card, page 243

CUTTING-OFF MACHINES

Bardons & Oliver, Inc., Ft. W. 9th St., Cleveland 13, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cone Automatic Mch. Co., Windsor, Vt. (Lathe Type).
Consolidated Mch. Tool Co., Rochester, N. Y.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Johnson Mfg. Co., Albion, Mich.
Landis Machine Co., Waynesboro, Pa. (Pipe).
Modern Machine Tool Co., 601 S. Water St., Jackson, Mich. (Lathe Type for Tubing).

CUTTING-OFF MACHINES, Abrasive Wheel

Allison Co., Bridgeport, Conn.
Campbell Mch. Div., American Chain & Cable 929 Conn. Ave., Bridgeport, Conn.
Columbia Div., Lodge & Shipley Co., Hamilton 1, Ohio.
Delta Power Tool Div., Rockwell Mfg. Co., 614 G. N. Lexington Ave., Pittsburgh 8, Pa.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.

CUTTING-OFF MACHINES, Cold Saw

See Sewing Machines, Circular

CUTTING-OFF MACHINES, Metal Band Saws

Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Famco Machine Co., 3134 Sheridan Rd., Kenosha, Wis.
Grob, Inc., Grafton, Wis.

CUTTING-OFF TOOLS

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Kennametal, Inc., Latrobe, Pa.
Luers, J. Milton, 12 Pine St., Mt. Clemens, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

CUTTING-OFF WHEELS, Abrasive

Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
Norton Co., 1 New Bond St., Worcester, Mass.
Simonds Abrasive Co., Tacony & Fraley Sts., Philadelphia 37, Pa.
Smit, J. K., & Sons, Inc., Murray Hill, N. J.

CYLINDER BORING MACHINES

Baker Bros., Inc., Sta. F, P. O. Box 101, Toledo 10, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Moline Tool Co., 102 20th St., Moline, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.

CYLINDERS, Air

Hannifin Corp., 1101 S. Kilbourn Ave., Chicago.
Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Tomkins-Johnson Co., Jackson, Mich.

CYLINDERS, Hydraulic

Barnes, John S., Corp., Rockford, Ill.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
National Forge & Ordnance Co., Irvine, Warren County, Pa.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4, Wis.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Rockford Machine Tool Co., 2500 Kiswaukee St., Rockford, Ill.
Tomkins-Johnson Co., Jackson, Mich.

DEALERS, Machinery

Botwinik Bros. of Mass., Inc., 14 Sherman St., Worcester, Mass.
Motch & Merryweather Mchry. Co., Penton Bldg., Cleveland, Ohio.
Ryerson, Jos. T., & Son, Inc. 2558 W. 16th St., Chicago 18, Ill.
Simmons Mch. Tool Corp., 1600 N. Broadway, Albany, N. Y.

DEMAGNETIZERS

Blanchard Mch. Co., 64 State St., Cambridge, Mass.
Heald Mch. Co., 10 New Bond St., Worcester 6, Mass.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Walker, O. S., Inc., Worcester, Mass.

DESIGNERS, Machine and Tool

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Hartford Specialty Mchry. Co., 287 Homestead St., Hartford, Conn.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

DIAMONDS AND DIAMOND TOOLS

Smit, J. K., & Sons, Inc., Murray Hill, N. J.

DIE-CASTING

See Castings, Die

DIE-CASTING MACHINES

Hydraulic Press Mfg. Co., Mt. Gilead, Ohio.
Lake Erie Engineering Corp., Kenmore Station, Buffalo, N. Y.

DIE CUSHIONS

Bliss, E. W. Co., 1375 Raff Rd., S. W. Canton, Ohio.
Clearing Mch. Corp., 6499 W. 65th St., Chicago, Ill.
Verson Allsteel Press Co., 93rd St. and S. Kenwood Ave., Chicago, Ill.

DIE INSERTS, Carbide

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Kennametal Inc., Latrobe, Pa.
Metal Carbides Corp., Youngstown, Ohio.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

DIEMAKERS' SUPPLIES

Bliss, E. W. Co., 1375 Raff Rd., S. W. Canton, Ohio.
Danly Mch. Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Producto Mch. Co., 990 Housatonic Ave., Bridgeport, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

DIEMAKING MACHINES

Grob, Inc., Grafton, Wis.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Kearney & Trecker Corp., Milwaukee, Wis.
Oliver Instrument Co., 1410 E. Moumee St., Adrian, Mich.

DIE SETS, Standard

Bliss, E. W. Co., 1375 Raff Rd., S. W. Canton, Ohio.
Danly Mch. Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Producto Mch. Co., 990 Housatonic Ave., Bridgeport, Conn.
U. S. Tool Co., Inc., 255 N. 18th St., Ampere, N. J.

DIE-SINKING MACHINES

American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Cincinnati Milling Mch. Co., Cincinnati, Ohio.
Gorton, George, Machine Co., 1110 W. 13th St. Racine, Wis.
Pratt & Whitney, West Hartford 1, Conn.

DIE-SINKING PRESSES

Baldwin-Lima-Hamiliton Corp., Philadelphia 42, Pa.
Kearney & Trecker Corp., Milwaukee, Wis.

DIE STOCKS

See Stocks, Die

DIES, Sheet Metal, Etc.

Bliss, E. W., Co., 1375 Raff Rd., S. W. Canton, Ohio.
Carboloy Dept. General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Chambersburg Engrg. Co., Chambersburg, Pa.
Columbus Die-Tool & Mch. Co., 955 Cleveland Ave., Columbus, Ohio.
Dreis & Krupp Mfg. Co., 7416 Loomis Blvd., Chicago 36, Ill.
Ferracute Mch. Co., Bridgeton, N. J.
John B., Manufacturing Co., Ellis St., New Britain, Conn.
Metal Carbides Corp., Youngstown, Ohio.
Niagara Mch. & Tool Wks. 683 Northland Ave., Buffalo, N. Y.
Richard Bros., Div. Allied Products Corp., 12619 Burt Rd., Detroit 23, Mich.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Verson Allsteel Press Co., 93rd St. and S. Kenwood Ave., Chicago, Ill.
Waltham Mch. Wks., Newton St., Waltham, Mass.
Winzeler Mfg. & Tool Co., 1712 West Arcade Pl., Chicago 12, Ill.

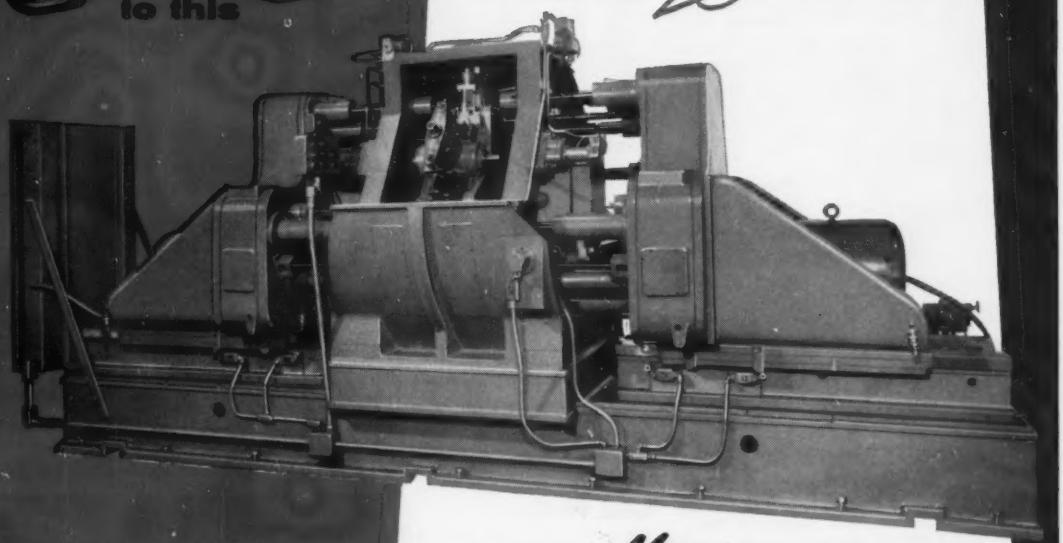
DIES, Threading

Butterfield Div., Union Twist Drill Co., Derby Line, Vt.
Card, S. W., Mfg., Mansfield, Mass.
Detroit Tap & Tool Co., 8615 E. 8 Mile Rd., Base Line, Mich.
Eastern Mch. Screw Corp., New Haven, Conn.
Geometric Tool Co., Westville Station, New Haven 15, Conn.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Pratt & Whitney, West Hartford 1, Conn.
Reed Rolled Thread Die Co., P.O. Box 350, Worcester 1, Mass.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Winter Bros. Co., Rochester, Mich.

(*Continued on page 328*)



...in just 23 seconds!



with this Morris mor-speed production machine

OPERATIONAL CYCLE:

STATION	
1	Double Load and Unload
2	Drill four 1" holes
3	Re-drill holes to 1 7/16"
4	Rough face four holes
5	Finish face four holes
6	Chamfer four holes

The Morris Two Way Horizontal High Production Machine finishes universal joint flange yokes at the rate of 156 per hour at 100% efficiency.

It, like other Morris MOR-SPEED Machines, is made up of standard MOR-SPEED units plus certain special parts. Because of Morris methods and standard designs, the user gets a special purpose machine . . . capable of high speed, precision production . . . without the usual sky-high cost and limited application of a "special machine."

Morris MOR-SPEED Machines save space, time and costs for leading manufacturers in every industry.

If you have multiple drilling, tapping, boring or similar operations on a mass production basis, Morris Engineers may may be able to show you substantial savings on a modest investment.

Morris

THE MORRIS MACHINE TOOL CO.
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CINCINNATI 3, OHIO

DIES, Threading, Opening

Eastern Mch. Screw Corp., New Haven, Conn.
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, S. I., N. Y.
Geometric Tool Co. Westville Station, New Haven 45, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
Landis Mch. Co., Waynesboro, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Sheffield Corp., 721 Springfield, Dayton, Ohio.

DIES, Thread Rolling

Detroit Tap & Tool Co., 8615 E. 8 Mile Rd., Base Line, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Reed Rolled Thread Die Co., P. O. Box 350, Worcester 1, Mass.
Sheffield Corp., 721 Springfield, Dayton, Ohio.

DISCS, Abrasives

Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Norton Co., 1 New Bond St., Worcester, Mass.
Simonds Abrasive Co., Tacony and Fraley Sts., Bridesburg, Philadelphia, Pa.
Smit, J. K. & Sons, Inc., Murray Hill, N. J.
Walls Sales Corp., 333 Nassau Ave. Brooklyn 22, N. Y.

DISINTEGRATORS

Elox Corp., 602 N. Rochester Rd., Clawson, Mich.

DIVIDING HEADS

See Indexing and Spacing Equipment

DOWELL PINS

Allen Mfg. Co., 133 Sheldon St., Hartford 2, Conn.
Danly Mch. Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
DoAll Co., 254 N. Laural Ave., Des Plaines, Ill.
Producto Machine Co., 990 Housatonic Ave., Bridgeport, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

DRESSERS, Grinding Wheel

Carboloy Dept., General Electric Co., Box 237 Roosevelt Park Annex, Detroit 32, Mich.
Colonial Broach Co., P.O. Box 37, Harper Sta., Detroit 13, Mich.
DoAll Co., 254 N. Laurel Ave., Des Plains, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hoglund Engrg. & Mfg. Co., Inc., Berkeley Heights, N. J.
Metal Carbides Corp., Youngstown, Ohio.
Meyers, W. F. Co., Bedford, Ind.
Moore Special Tool Co., Inc., 724 Union Ave., Bridgeport, Conn.
Norton Co., 1 New Bond St., Worcester, Mass.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Vinco Corp., 9113 Schaefer Hwy., Detroit 28, Mich.

DRIFTS, DRILL

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILL HEADS, Multiple Spindle

Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
Canedy-Otto Div., Cincinnati Lathe & Tool Co., Oakley, Cincinnati, Ohio.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, S. I., N. Y.
Etto Tool Co., Inc., 592 Johnson Ave., Brooklyn, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit, Mich.
Govro-Nelson Co., Detroit 8, Mich.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Moline Tool Co., 102 20th St., Moline, Ill.
Snyder Tool & Engrg. Co., 3400 Lafayette, Detroit 7, Mich.
Thriftmaster Products Corp., 1076 N. Plum St., Lancaster, Pa.
United States Drill Head Co., 616 Burns, Cincinnati, Ohio.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

DRILL HEADS, Unit Type

Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Keller Tool Co., Grand Haven, Mich.
Kingsbury Mch. Tool Corp., Keene, N. H.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Morris Machine Tool Co., Inc., 946-H Harriet St., Cincinnati 3, Ohio.
Rehnberg-Jacobson Mfg. Co., 2135 Kishwaukee St., Rockford, Ill.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.

DRILL SOCKETS

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILL STANDS

Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILL STOPS

Wohlnip Engineering Co., 390 Hillside Ave., Hillside, N. J.

DRILLING MACHINES, Automatic

Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Bodine Corp., Mt. Grove St., Bridgeport, Conn.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Kingsbury Mch. Tool Corp., Keene, N. H.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Morris Machine Tool Co., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Turner Bros., Inc., 2625 Hilton Rd., Ferndale 20, Mich.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

DRILLING MACHINES, Bench

Avey Drilling Mch. Co., 126 E. Third St., Covington, Ky.
Buffalo Forge Co., 490 Broadway, Buffalo.
Canedy-Otto Div., Cincinnati Lathe & Tool Co., Oakley, Cincinnati, Ohio.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Edlund Machinery Co., Cortland, N. Y.
Famco Machine Co., 3134 Sheridan Rd., Kenosha, Wis.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Walker-Turner Div., Kearney & Treckar Corp., 900 North Ave., Plainfield, N. J.

DRILLING MACHINES, BOILER

Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland.

DRILLING MACHINES, Deep Hole

Avery Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Pratt & Whitney, West Hartford 1, Conn.

DRILLING MACHINES, Gang

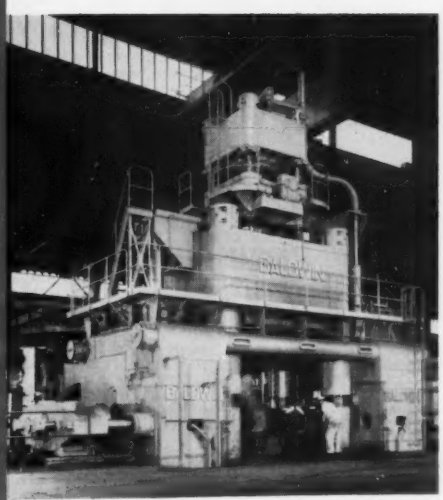
Avery Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Cleereman Mch. Tool Co., Green Bay, Wis.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Edlund Machinery Co., Cortland, N. Y.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Turner Bros., Inc., 2625 Hilton Rd., Ferndale 20, Mich.

DRILLING MACHINES, Horiz. Duplex

Avery Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes W. F. & John Co., 201 S. Water St., Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Consolidated Mch. Tool Corp., Rochester, N. Y
Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Edlund Machinery Co., Cortland, N. Y.
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Kingsbury Mch. Tool Corp., Keene, N. H.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Moline Tool Co., 102 20th St., Moline, Ill.

(Continued on page 330)





These propeller blanks were forged on Cameron's 26,000 ton multiple ram split-die ferrous metal forging press.

ANOTHER LARGE SIZE AND INTRICATE SHAPE IS FORGED

Pictured above are 64" aircraft propeller blanks now being forged from steel, rough machined and cold pressed at Cameron Iron Works, Houston. These forgings, free of inclusions and crevices, are then drawn and shaped by the prime contractor into propeller blades.

You too may have the need for forgings which will result in improved quality products at lower manufacturing costs.

FORGE AND ORDNANCE DIVISION

Cameron

IRON WORKS, INC.
HOUSTON, TEXAS

Write today for further information.

Challenge

TRADE MARK

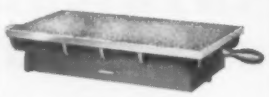
THE STANDARD FOR ACCURACY!

IN PRECISION EQUIPMENT

A complete line designed for more efficient . . .
LAYOUT, INSPECTION, CHECKING, LAPPING, WELDING AND ASSEMBLY WORK



including **CHALLENGE LAYOUT SURFACE PLATES** in 16 sizes, precision ground or planer finished - for a wide range of functions. Plates can be grooved and keyed so that two or more can be assembled and mounted into one complete unit. With "T-Slots" or with grooving, scoring or machining.



. . . **SEMI-STEEL SURFACE PLATES** made of fine-grain special analysis semi-steel castings, heat treated. Three-point suspension with heavy, deep ribs on the underside.

PLUS . . .

Clamp Edge Layout Plates
Checking Tables
Welding Tables
Bench Plates and Blocks

Send for free copy of Challenge Catalog showing complete line of precision equipment.

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THE CHALLENGE MACHINERY CO.
Office, Factories and Show Room
GRAND HAVEN, MICHIGAN

Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

DRILLING MACHINES, Horizontal Portable

Avery Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.

DRILLING MACHINES, Inverted

Avery Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.

DRILLING MACHINES, Multiple Center Column Type

Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.

DRILLING MACHINES, Multiple Spindle

Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Burg Tool Mfg. Co., 3743 Durango Ave., Los Angeles 34, Cal.
Canedy-Otto Div., Cincinnati Lathe & Tool Co., Oakley, Cincinnati, Ohio.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Cleereman Mch. Tool Co., Green Bay, Wis.
Cosa Corp., 405 Lexington Ave., New York 17.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Edlund Machinery Co., Cortland, N. Y.
Famco Machine Co., 3134 Sheridan Rd., Kenosha, Wis.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Greenlee Bros. & Co., 12th and Columbia Ave., Rockford, Ill.
Hartford Special Mchry, Co., 287 Homestead St., Hartford, Conn.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kingsbury Mch. Tool Corp., Keene, N. H.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Pratt & Whitney, West Hartford 1, Conn.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Turner Bros., Inc., 2625 Hilton Rd., Ferndale 20, Mich.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

DRILLING MACHINES, Radial

American Tool Works Co., Pearl and Eggleston Aves., Cincinnati, Ohio.
Canedy-Otto Div., Cincinnati Lathe & Tool Co., Oakley, Cincinnati, Ohio.
Carlton Mch. Tool Co., 3000 Spring Grove Ave., Cincinnati 25, Ohio.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Cincinnati Gilbert Machine Tool Co., 3366 Beekman St., Cincinnati 23, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Foot-Burt Co., 1300 St. Clair Ave., Cleveland, Ohio.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Kaukauna Machine Corp., Kaukauna, Wis.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.

DRILLING MACHINES, Rail

See Drilling Machines, Gang

DRILLING MACHINES, Sensitive

Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Canedy-Otto Div., Cincinnati Lathe & Tool Co., Oakley, Cincinnati, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Edlund Machinery Co., Cortland, N. Y.
Famco Machine Co., 3134 Sheridan Rd., Kenosha, Wis.
Foot-Burt Co., 1300 St. Clair Ave., Cleveland, 8, Ohio.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Pratt & Whitney, West Hartford 1, Conn.
Ryerson, Jos. T. & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Snow Mfg. Co., 435 Eastern Ave., Bellwood Ill.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

DRILLING MACHINES, Upright

Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Baush Mch. Tool Co., 156 Wason Ave., Springfield 7, Mass.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Canedy-Otto Div., Cincinnati Lathe & Tool Co., Oakley, Cincinnati, Ohio.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Cleereman Mch. Tool Co., Green Bay, Wis.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Edlund Machinery Co., Cortland, N. Y.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland 8, Ohio.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
Moline Tool Co., 102 20th St., Moline, Ill.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.

(*Continued on page 332*)

New BAKER Automatic MACHINES 15,000 lb. TANK HULL as it passes along 100 FOOT RAILS!



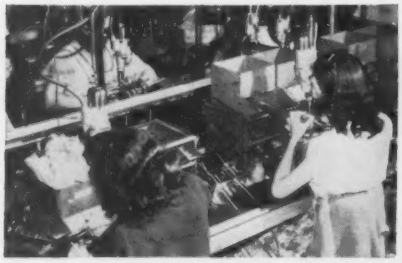
OPERATIONS: DRILLING . . . TAPPING . . . BORING . . . FACING on 102 holes . . . 10 main bores Mounted on a specially-built floating concrete slab, this huge new Automatic Baker Transfer Machine accurately performs multiple drilling, tapping, boring and facing operations on 15,000 pound rough weldments 9 feet wide and 16 feet long. Savings achieved in production costs with a machine of this type are tremendous. Baker engineering know-how stands ready to solve your production problems . . . with cost cutting standard or special, single or multi-operation machines.

Write regarding your specific job problems . . .

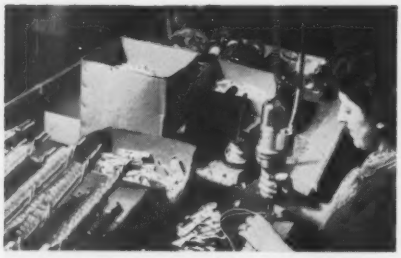
BAKER BROTHERS, INC. Toledo, Ohio
DRILLING . . . TAPPING . . . KEYSEATING and CONTOUR GRINDING MACHINES

"400% Faster!"
"Output Up 110%!"
"Costs Cut 64%!"

6 typical examples of how Millers Falls "Adjustomatic"® Clutch Electric Screw Drivers are saving time and money on thousands of assembly lines



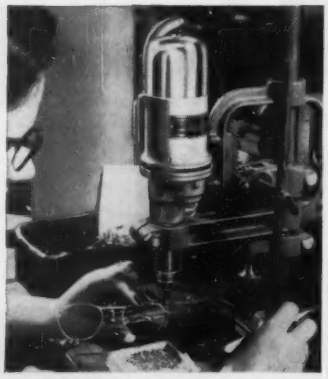
TV TUNERS. High power combined with hair-fine torque control — those are the qualities that won Millers Falls the nod over competing drivers on this exacting application.



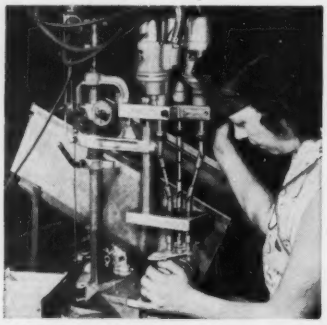
TRAVERSE TRACKS. Drive screws too tight — and tracks crush. Not tight enough — and stops loosen. Millers Falls' record on this job: Rejects, nil — speed, up 400%.

MINIATURE MOTORS. Problem: To drive tiny self-tapping screws without stripping or splitting a thin plastic housing. **Solution:** Millers Falls No. 52's. **Result:** Production up 110%.

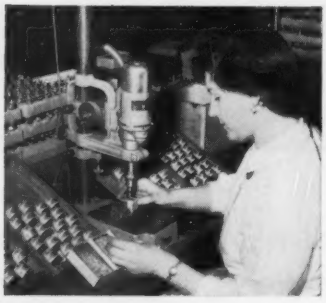




EYE GLASS FRAMES. Driving tiny optical screws — traditionally an "impossible" job for a power driver. Yet Millers Falls drivers are doing it — and cutting labor costs 64%.



WINDSHIELD WIPERS. Ingenious, multiple-driver installations like this are one secret of the success of a leading manufacturer in this highly competitive field.



HEATING CONTROLS. Speed, accuracy, economy — on all three counts, this manufacturer chose Millers Falls after extensive tests with other electric and pneumatic drivers.

There's a Millers Falls Driver that's Right for Practically Every Driving Problem

Write for full information or let us arrange a demonstration on Millers Falls drivers and many other high-performance electric tools for production and maintenance.

MILLERS FALLS COMPANY
Greenfield, Mass.

MILLERS FALLS TOOLS
SINCE 1868
The Mark of Superiority

Rehnberg-Jacobson Mfg. Co., 2135 Kishwaukee St., Rockford, Ill.
Ryerson, Jos. T. & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Snow Mfg. Co., 435 Eastern Ave., Bellwood Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

DRILLING MACHINES, Wall, Radial

Cleveland Punch & Shear Works., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.

DRILLS, Center

Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Greenfield Tap & Die Corp., Greenfield, Mass.
Keo Cutters, 19326 Woodward, Detroit, Mich.
National Twist Drill & Tool Co., Rochester, Mich.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Core

Corboloy Dept., General Electric Co., Box 237 Roosevelt Park Annex, Detroit 32, Mich.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling, Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
McCosky Tool Corp., 1938 Thomas St., Meadville, Pa.
National Twist Drill & Tool Co., Rochester, Mich.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Smit, J. K., & Sons, Inc., Murray Hill, N. J.
Super Tool Co., 21650 Hoover Rd. Detroit 13, Mich.
Union Twist Drill Co., Athol, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

DRILLS, Deep Hole

Pratt & Whitney, West Hartford 1, Conn.
Smit, J. K., & Sons, Inc., Murray Hill, N. J.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Portable Electric

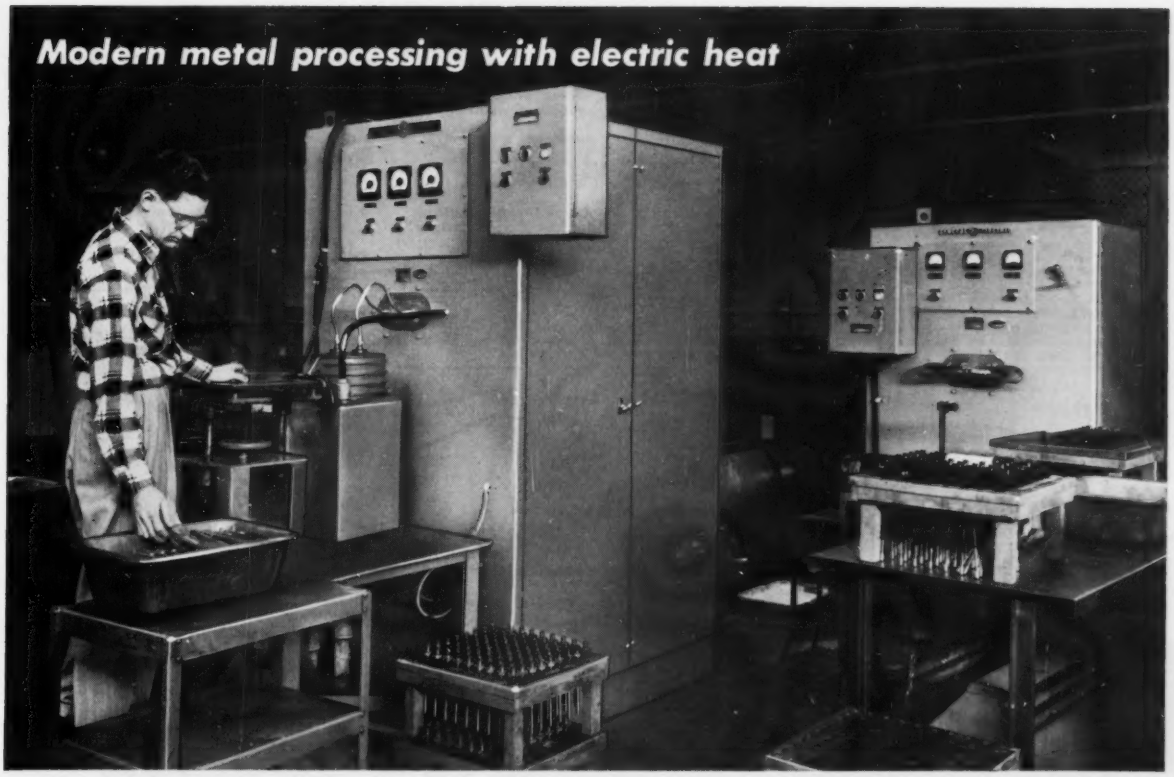
Black & Decker Mfg. Co., Towson, Md.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Millers Falls Co., Greenfield, Mass.
Ryerson Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.

DRILLS, Portable Pneumatic

Chicago Pneumatic Tool Co., 6 E. 44th St. New York 9, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.
Keller Tool Co., Grand Haven, Mich.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.

(*Continued on page 334*)

For more information on products advertised, use Inquiry Card, page 243



BUFFALO ARMS HAS BEEN USING G.E.'S 20-KW AND 5-KW INDUCTION HEATERS FOR 2½ YEARS WITHOUT A MAJOR BREAKDOWN.

Says Buffalo Arms:

"G-E induction heaters insure quality guns that meet rigid government requirements"

General Electric induction heaters perform dependably whether they are used for hardening, brazing, annealing, or soldering, reports Buffalo Arms, Inc., Akron, N. Y. ordnance equipment manufacturer.

Says W. I. Wood, Chief Methods Engineer: "The aircraft guns we produce have many working parts that require special heat treating and hardening to insure their dependable performance. Our G-E induction heaters give us that degree of accuracy and uniformity needed to meet rigid government standards and assure top quality in our finished product."

FOR APPLICATION ASSISTANCE

To learn how you can profitably apply induction heat in your metal processing, contact your nearest G-E Apparatus Sales representative. And write for the new, modern-metal-processing bulletin, GEA-5889, on furnace and induction brazing. Address: General Electric Company, Section 720-133, Schenectady 5, N. Y.

GENERAL ELECTRIC



SELECTIVE HARDENING of this breech-block slide is a typical operation at Buffalo Arms.

For more information on products advertised, use Inquiry Card, page 243

DRILLS, Rachet
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago III.
Chicago-Latrobe Twist Drill Works 411 W. Ontario St., Chicago, III.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Union Twist Drill Co., Athol, Mass
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Twist
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, III.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, III.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Greenfield Tap Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Wire
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago III.
Greenfield Tap & Die Corp. Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRIVES, Chain
Link-Belt Co., 220 S. Belmont Ave., Indianapolis 6, Ind.

DUPLICATORS
Gorton, George, Mch. Co. 1110 W. 13th St., Racine, Wis.
Lehigh Foundries, Inc., 1500 Lehigh Dr. Easton, Pa.
Pratt & Whitney, West Hartford 1, Conn.
Richford Mch. Tool Co., 2500 Kishwaukee St., Rockford, III.

DUST COLLECTORS
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Pangborn Corp., Hagerstown, Md.

DUST CONTROL SYSTEMS
Pangborn Corp., Hagerstown, Md.

ELECTRICAL EQUIPMENT
General Electric Co., Schnectady 5, N. Y.

EMERY WHEEL DRESSERS
See Dressers, Grinding Wheel

EMERY WHEELS
See Grinding Wheels

ENGRAVING MACHINES
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gorton Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.

EXTRACTORS, Drill
Wohlnip Engineering Co., 390 Hillside Ave., Hillside, N. J.

EXTRACTORS, Screw
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

FACING MACHINES
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
National Automatic Tool Co., Inc., S. 7th and N Sts., Richmond, Ind.

FANS, Exhaust, Electric Ventilating
Buffalo Forge Co., 490 Broadway, Buffalo. N. Y.
General Electric Co., Schenectady 5, N. Y.

FEEDS FOR PRESSES, Automatic
Federal Press Co., 600 Division and Big Four R. R. Elkhart, Ind.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

FELT, For All Applications
American Felt Co., Glenville, Conn.

FILES, Hack
DoAll Co., 254 Laural Ave., Des Plaines, III.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.

FILES, Hand
DoAll Co., 254 Laurel Ave., Des Plaines, III.
Heller Bros. Co., Newcomerstown, Ohio.
Nicholson File Co., 23 Acorn St., Providence, R. I.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.

FILES Machine
DoAll Co., 254 Laurel Ave., Des Plaines, III.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.

FILES AND BURS, Rotary
DoAll Co., 254 N. Laurel Ave., Des Plaines, III.
Pratt & Whitney, West Hartford 1, Conn.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

(*Continued on page* 336)





Double-Circle Drills run all the way from watchmaker's .0059 diameter (too small to illustrate in its true size) to a giant 3½" or larger, diameter drill. These are the extremes. In between are literally hundreds of the more commonly called for sizes in the exact design you require.

Each one is the finest possible tool of its type. Starting with top-quality pre-tested steels, they are produced under a precision control system that insures a perfect drill every time. Order Double-Circle and watch their fine quality give you "greater cutting mileage". . . keep your tool costs down. Your distributor can supply you.

YOU'LL GET
QUICK SERVICE
FROM A
CHICAGO-LATROBE DISTRIBUTOR

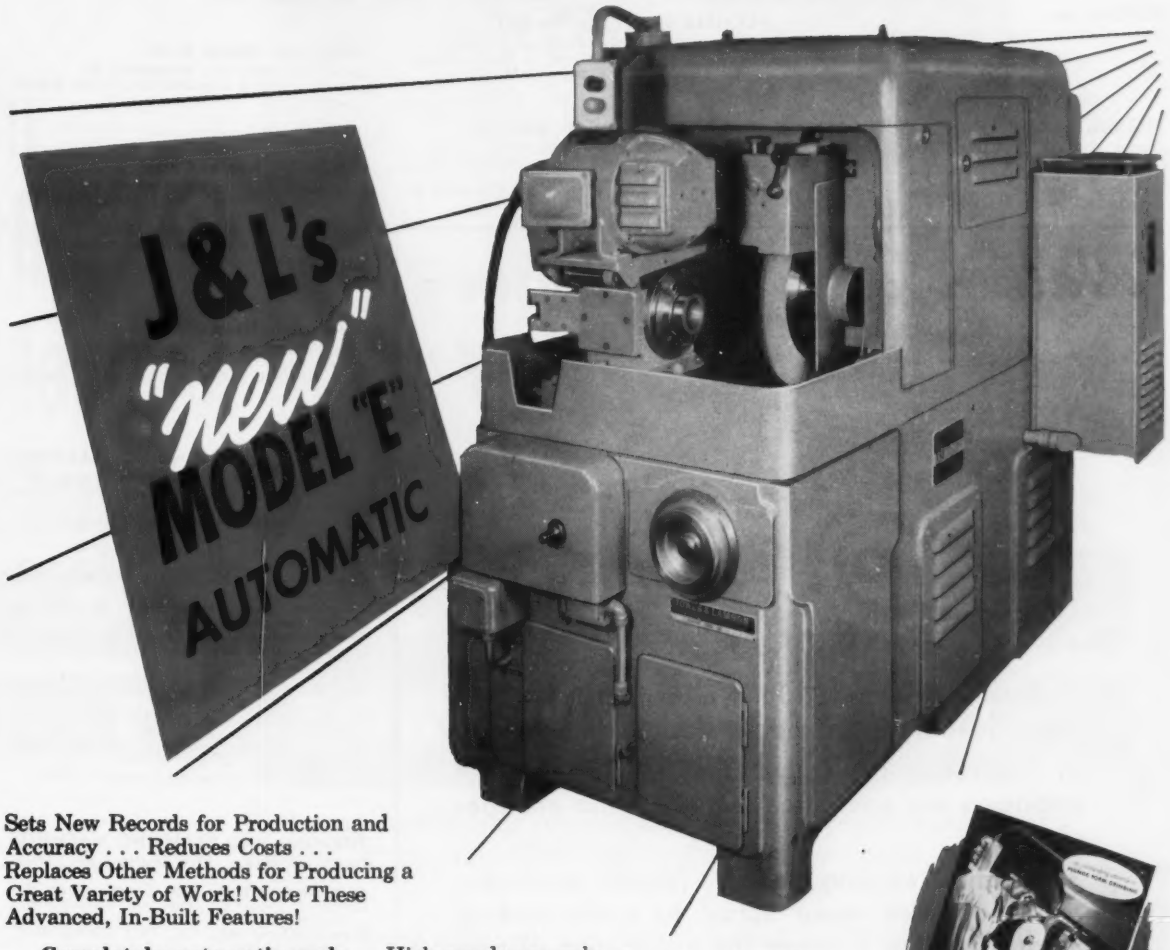
DOUBLE CIRCLE TOOLS

CHICAGO-LATROBE
417 W. ONTARIO ST. CHICAGO 10

DRILLS • REAMERS • COUNTERSINKS • COUNTERBORES • CARBIDE TOOLS • SPECIAL TOOLS

For more information on products advertised, use Inquiry Card, page 243

An Outstanding Advance
in PLUNGE FORM GRINDING



Sets New Records for Production and Accuracy . . . Reduces Costs . . . Replaces Other Methods for Producing a Great Variety of Work! Note These Advanced, In-Built Features!

- **Completely automatic cycle** — High speed approach, wheel feed spark out and withdrawal are positively controlled through simple cam action — ensuring constant, uniform operation under all conditions.
- **Automatic positive size control** — The wheel slide is held against positive stops with uniform hydraulic pressure.
- **Automatic trueing device** with controlled dressing.
- **Automatic or manual handling.**
- **Complete versatility** — chucking work, center work or shoe-type grinding; crush wheel or diamond trueing.
- **Compact design** — affords exceptional accessibility and simple set-ups.



Write for illustrated folder — gives complete specifications and examples of how the Model "E" does jobs faster, better and more economically.

JONES & LAMSON

Machine Tool Craftsmen Since 1835

JONES & LAMSON MACHINE CO., 512 Clinton St., Dept. 710, Springfield, Vt., U.S.A.

MACHINE TOOL DIV.

For more information on products advertised, use Inquiry Card, page 243

FILING MACHINES, Dies, Etc.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Grob, Inc., Grafton, Wis.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.

FILTERS, Air
Keller Tool Co., Grand Haven, Mich.

FILTERS, Coolant and Oil
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Cuno Engrg. Corp., Meriden, Conn.
Industrial Filtration Co. (Delpark Corp.) 15 Industrial Ave., Lebanon, Ind.

FINISHES FOR MACHINES AND METAL PARTS
Lowe Bros. Co., Dayton, Ohio.

FLEXIBLE COUPLINGS
See Couplings, Flexible

FLEXIBLE SHAFT EQUIPMENT
Pratt & Whitney West Hartford 1, Conn.
Walker-Turner Div., Kearney & Trecker Corp., 900 North Ave., Plainfield, N. J.

FORGINGS, (Upsetting) Machines
Ajax Mfg. Co., Euclid, Cleveland 17, Ohio.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
National Machinery Co., Greenfield and Stanton Sts., Tiffin, Ohio.

FORGINGS, Drop
Bethlehem Steel Co. Bethlehem, Pa.
Mueller Brass Co., Port Huron 35, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

FORGINGS, Hollow Bored
Bethlehem Steel Co., Bethlehem, Pa.
National Forge & Ordnance Co., Irvine, Warren County, Pa.

FORGINGS, Iron and Steel
Bethlehem Steel Co., Bethlehem, Pa.
Cameron Iron Works, Inc., 1000 Silber Rd., Houston, Texas.
Morgan Engrg. Co., Alliance, Ohio.
National Forge & Ordnance Co., Irvine, Warren County, Pa.

FORGINGS, Upset
Bethlehem Steel Co., Bethlehem, Pa.
Mueller Brass Co., Port Huron 35, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

FORMING AND BENDING MACHINES
American Steel Foundries, Elmes Engrg. Div., Paddock Rd., and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Chambersburg Engrg. Co., Chambersburg, Pa.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Dreis & Krump Mfg. Co., 7416 Loomis Blvd., Chicago 36, Ill.
Ferracute Machine Co., Bridgeton, N. J.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Yoder Co., 5500 Walworth, Cleveland, Ohio.

FORMING AND STAMPING MACHINES
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Chambersburg Engrg. Co., Chambersburg, Pa.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Dreis & Krump Mfg. Co., 7416 Loomis Blvd., Chicago 36, Ill.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

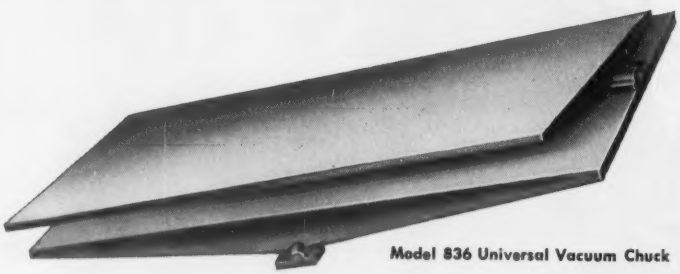
FORMING TOOLS or Tool Blanks
Brown & Sharpe Mfg. Co., Providence, R. I.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Kennametal, Inc., Latrobe, Pa.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

FRAMES, Machinery Welded
Mahon, R. H. Co., Detroit 34, Mich.

FURNACES, Heat-Treating
General Electric Co., Schenectady 5, N. Y.

(*Continued on page* 338)

Walker Does It Again-



Model 836 Universal Vacuum Chuck

The evolution of a satisfied Walker customer:

1. Problem submitted to Walker technicians (75 years' leadership in special designs for chucks).
2. Theoretical research and discussion. (Walker engineers are scientifically trained and are specialists).
3. Practical working models. (Walker engineers and shop men make actual to scale working models). Here is where the application of true scientific principles is utilized.
4. Customer proposal based upon years of experience and a combination of engineering study and practicability.
5. Conclusion: Another Satisfied Walker Customer.

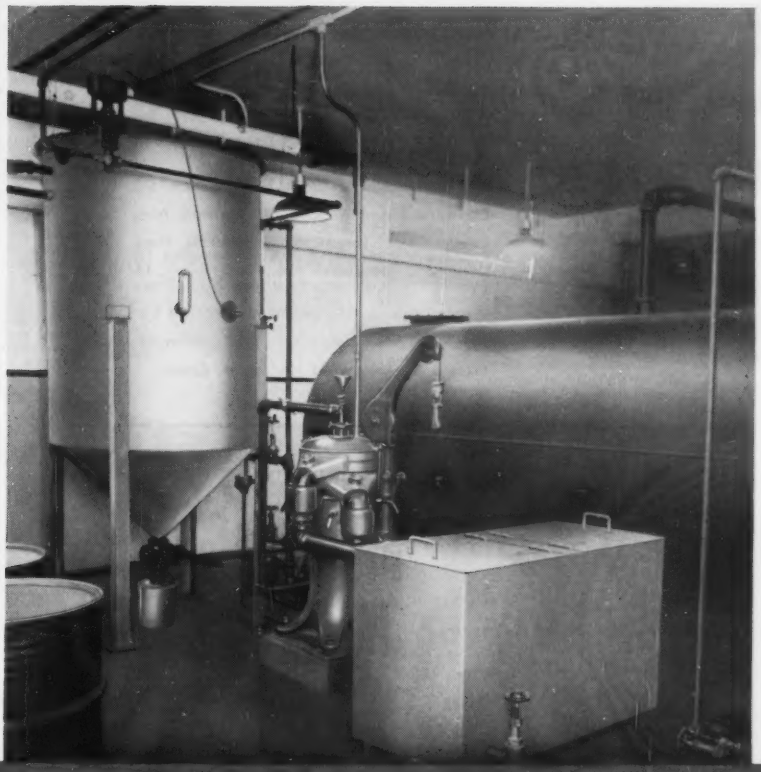
ACTION—RESULTS—SATISFACTION

Hold Everything with Walker Chucks

O. S. WALKER CO. Inc.
WORCESTER 6, MASSACHUSETTS
Original Designers and Builders of Magnetic Chucks

For more information on products advertised, use Inquiry Card, page 243

Cutting oil purification, storage, and distribution center in a large aircraft parts plant.



In the Machine Shop...

DE LAVAL CENTRIFUGALS PAY FOR THEMSELVES!

De Laval Centrifugals provide the quickest low-cost method of keeping factory oils clean and dry and of preparing coolants for re-use.

They bring about substantial production economies not only by the oil or coolant they save, but also in many other ways.

For example, here are some of the gains made when a De Laval Purifier keeps *cutting oils* free of abrasive particles: higher cutting speeds are permissible; tool life is often *doubled;* more accurate work is consistently performed; there is less wear on machine bearings lubricated largely by the cutting oil.

Regardless of what you manufacture, if you use machine tools to make it, it will pay you to investigate the *money-saving* possibilities of De Laval Centrifugals.

THE DE LAVAL SEPARATOR COMPANY
Poughkeepsie, New York ● 427 Randolph St., Chicago 6
DE LAVAL PACIFIC CO., 61 Beale St., San Francisco 5

DE LAVAL PURIFIERS & CLARIFIERS FOR FACTORY OILS

FURNITURE, Shop
Standard Pressed Steel Co., Jenkintown, Pa.

GAGE BLOCKS
Brown & Sharpe Mfg. Co., Providence, R. I.
Dearborn Gage Co., 22038 Beech St., Dearborn, Mich.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Pratt & Whitney, West Hartford 1, Conn.
Scherr, George, Co., Inc. 200 Lafayette St., New York 12, N. Y.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Van Keuren Co., 176 Waltham St., Watertown, Boston, Mass.

GAGES, Air
Cosa Corp., 405 Lexington Ave., New York 17.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P. O. Box 1027, Providence, R. I.

GAGES, Comparator
Amco Gage Co., 19760 W. 8 Mile Rd., Detroit 19, Mich.
Ames, B. C., Co., Waltham 54, Mass.
Baptist Machine Co.. Inc., 36 Ludlow St., Stamford, Conn.
Cleveland Instrument Co., 735 Carnegie Ave., Cleveland 15, Ohio.
Comtor Co., 47 Farwell St., Waltham 54, Mass.
Cosa Corp., 405 Lexington Ave., New York 17.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
Hanson-Whitney Co., Div. Whitney Chain Co., Hartford, Conn.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
Pratt & Whitney, West Hartford 1, Conn.
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GAGES, Depth
Ames, B. C., Co., (Dial), Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Dearborn Gage Co., 22038 Beech St., Dearborn, Mich.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
Hanson-Whitney Co., Div., Whitney Chain Co., Hartford, Conn.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Millers Falls Co., Greenfield, Mass.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

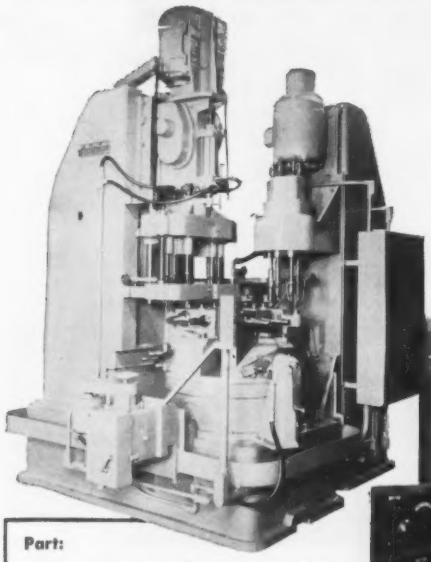
GAGES, Dial
Ames, B. C., Co., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Scherr, George, Co. Inc. 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Standard Gage Co., Inc., Poughkeepsie N. Y.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket R. I.

GAGES, Electric
Cleveland Instrument Co., 735 Carnegie Ave., Cleveland 15, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P. O. Box 1027 Providence, R. I.
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield, Dayton, Ohio.

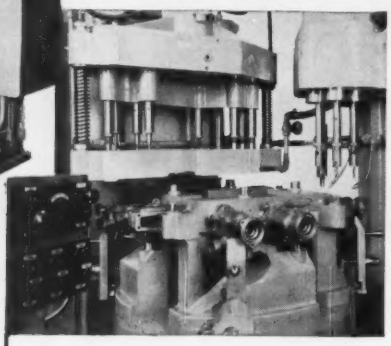
GAGES, Height
Amco Gage Co., 19760 W. 8 Mile Rd. Detroit 19, Mich.
Ames, B. C., Co., Waltham 54 Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Instrument Co., 735 Carnegie Ave., Cleveland 15, Ohio.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp. 721 Springfield, Dayton, Ohio.
Starrett, The L. S., Co., Athol Mass.

GAGES, Plug, Ring and Snap
Amco Gage Co., 19760 W. 8 Mile Rd., Detroit 19, Mich.
Axelson Mfg. Co., P. O. Box 15335, Vernon Sta., Los Angeles 58, Calif.
Brown & Sharpe Mfg. Co., Providence, R. I.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Dearborn Gage Co., 22038 Beech St., Dearborn, Mich.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hanson-Whitney Co., Div., Whitney Chain Co., Hartford, Conn.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Kennametal Inc., Latrobe, Pa.
Metal Carbides Corp., Youngstown, Pa.
Pratt & Whitney, West Hartford 1, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp. 721 Springfield, Dayton, Ohio
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, The L. S., Co. Athol Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Turner Bros. Inc., 2625 Hilton Rd., Ferndale 20, Mich.
Van Keuren Co., 176 Waltham St., Watertown, Boston, Mass.
Vinco Corp., 9113 Schaefer Hwy., Detroit 28, Mich.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

(*Continued on page 340*)



MULTIPLY PROFITS BY MULTIPLE OPERATIONS



Part:

Steering gear housing. (Two different parts run on same machine with tool change only.)

Material: Malleable iron.

Operation: *Station 1*—Load and unload. *Station 2*—Drill (3) .368" holes; (1) .120" hole. *Station 3*—Combination spot face and chamfer (3) holes, drill (1) 23/32" hole for tapping. *Station 4*—Tap (3) 7/16"-14 NC-3 thread; tap 1/2"-14 NPSF thread.

Description: Millholland 4-station automatic index machine equipped with 4-station automatic index table, with 1 No. 5 Millholland Automatic Unit driven by 7-1/2 HP motor with 8-spindle ball bearing multiple head for drilling 5 holes and combination spot facing and chamfering 3 holes; 4-spindle tapper on right-hand column.

Operator loads part and pushes button initiating automatic cycle, unloads. Two parts machined at a time.

MILLHOLLAND ENGINEERED FOR MAXIMUM PRODUCTION

For special production machines, Millholland Automatic Units offer distinct advantages. These self-contained units, driven by individual motors, are readily adapted to a wide range of operations. Their full automatic cycle with interlocked controls permits several units to be grouped for simultaneous operations, or they can be mounted on other production machines and synchronized to perform additional operations. Millholland Automatic Units have proved themselves in 30 years of outstanding performance on all types of jobs. Get full details in Bulletin M-9.

W. K. MILLHOLLAND MACHINERY CO.
6402 Westfield Blvd., Indianapolis 2, Indiana

For more information on products advertised, use Inquiry Card, page 243

Buck DOES IT AGAIN!



Brings You the FIRST – and ONLY– .001" Precision Air Chuck!

• • •

Saves Hours of Down Time

• • •

Permits Hardened Jaws for ALL Operations

• • •

10" and 12" Chucks— 2 or 3 Jaws

• • •

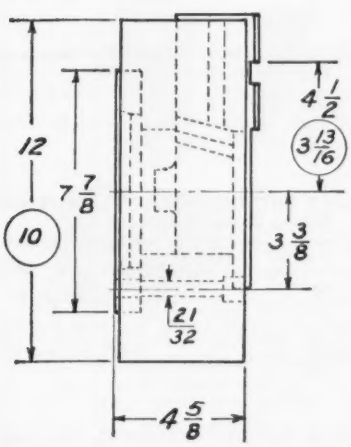
It looks like any other wedge-type chuck . . . operates much the same . . . but here, for the first time, is an air chuck that guarantees precision within .001" and practically eliminates down time.

It ends the time-wasting trial and error method of fitting jaws — the turning or grinding jaws on the chucking machines. Now, *jaws can be machined in the tool room while the automatics continue production,* because the final precision adjustment is made with the "Ajust-Tru" feature of the Buck chuck.

Now, soft jaws of quick wear can be replaced with hardened jaws — for holding rough castings or forgings for first operations, or the more critical second operations. The Buck also permits jobs and their jaws to run intermittently and interchangeably *without need to retrue the jaws* each time the job is set up.

The Buck can be adjusted while gripping work with full air pressure — to prevent inaccuracy. And for safety, it keeps its gripping power should an air line break exhaust the cylinder.

For accuracy and savings never before possible with an air chuck — get a Buck. *There's no price premium.* Send for literature with complete details.



Principal dimensions on the 10" and 12" chuck mounted to an A1-8" American Standard Spindle Nose.

CIRCLED DIMENSIONS FOR 10" DIAMETER CHUCK.

Buck AJUST-TRU® CHUCKS

The Buck Ajust-Tru principle is a unique chuck development.

Jaws grip work like any other scroll or air chuck. *After work is gripped* opposed screws near the back of the chuck are used *to move the chuck on the adapter* to bring work to dead true alignment. No further adjustment needed to chuck duplicate parts.

On hand-operated chucks jaws always come back to within .0005"— on air chucks to within .001".

Buck TOOL CO.

920a SCHIPPERS LANE

KALAMAZOO, MICHIGAN

GAGES, Surface

Amco Gage Co., 19760 W. 8 Mile Rd., Detroit 19, Mich.
Ames, B. C., Co., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Columbus Die-Tool & Mch. Co., 955 Cleveland Ave., Columbus, Ohio.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Hanson-Whitney Co., Div. Whitney Chain Co., Hartford, Conn.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Millers Falls Co., Greenfield, Mass.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Starrett, The L. S., Co., Athol Mass.

GAGES, Taper

Brown & Sharpe Mfg. Co., Providence, R. I.
Dearborn Gage Co. 22038 Beech St., Dearborn, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Starrett, The L. S., Co., Athol Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GAGES, Thread

Axelson Mfg. Co., P. O. Box 15335, Vernon Sta., Los Angeles 58, Calif.
Detroit Tap & Tool Co., 8615 E. 8 Mile Rd., Base Line, Mich.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hanson-Whitney Co., Div. Whitney Chain Co., Hartford, Conn.
Iroquois Corp., RFD 4 Box 331, 1800 E. 11 Mile Rd., Royal Oak, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GASKETS

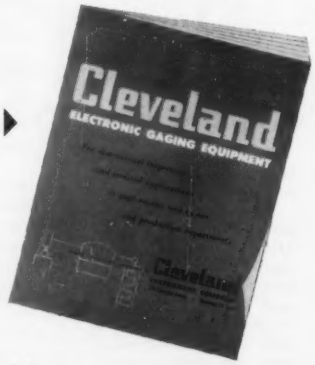
Crane Packing Co., 1800 Cuyler Ave., Chicago.
Garlock Packing Co., Palmyra, N. Y.

Cleveland..the BEST* in Precision Gaging

Cleveland electronic gaging equipment offers **unusual advantages** in dimensional inspection and control applications — in gage rooms, tool rooms, and production departments. Here are some of the reasons why:

- Frictionless gage head movement and drift-free amplifier assure CONSISTENT REPEAT READINGS.
- WIDE CHOICE OF SENSITIVITIES — from .0005" (or more) to .0000005" per scale division, depending on the equipment selected.
- VERSATILE. Checks concentricity, runout, roundness, taper, size. Used for automatic gaging and sorting; automatic control; machine referencing; recording of measurements. Readily used with special fixtures. Standard models include the INDI-AC electronic indicator; PAR-AC production gage; MICRO-AC microcomparator (reads in millionths — or half-millionths).
- EASY TO READ. Has continuous linear scales over two ranges, used interchangeably at will; widely-spaced scale divisions; fast meter response, without overshoot.
- PRACTICAL. Has fast, easy setup; fast warmup; low contact pressure. Rugged; portable; built for shop use. No special skill required.

FREE BULLETIN 542 gives full details — describes the equipment and how it works — shows shop, tool room and gage room applications of many kinds. Write for it! You'll be interested, and may find it a bit of an eye-opener.



*BEST? Ask the USERS listed in the bulletin — or any others. Names on request.

Designed, developed and manufactured by

Cleveland INSTRUMENT CO.
735-2 CARNEGIE AVE. CLEVELAND 15, OHIO

GEAR BLANKS, Non-Metallic

Braun Gear Co., 239 Richmond, Brooklyn 8, N. Y.
General Electric Co., Schenectady 5, N. Y.

GEAR BURNISHING MACHINES

Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Sheffield Corp., 721 Springfield, Dayton, Ohio.

GEAR CHAMFERING, ROUNDING AND BURRING MACHINES

Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia, Pa.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Lipe-Rollway Corp., 806 Emerson Ave., Syracuse, N. Y.
Modern Industrial Engrg. Co., 14230 Birwood, Detroit 4, Mich.
Sheffield Corp., 721 Springfield, Dayton, Ohio.

GEAR CHECKING INSTRUMENTS AND EQUIPMENT

Brown & Sharpe Mfg. Co., Providence, R. I.
Eastman Kodak Co., Rochester, N. Y.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S. Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Vinco Corp., 9113 Schaefer Highway, Detroit 28, Mich.

GEAR CUTTING MACHINES, Bevel Gears (Generators)

Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia, Pa.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

GEAR CUTTING MACHINES Bevel Gears, Spiral

Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

GEAR CUTTING MACHINES, Spur and Bevel Gears (Rotary Cutter)

Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Waltham Machine Works, Newton St., Waltham, Mass.

GEAR CUTTING MACHINES, SPUR and Helical Gears (Hobbing)

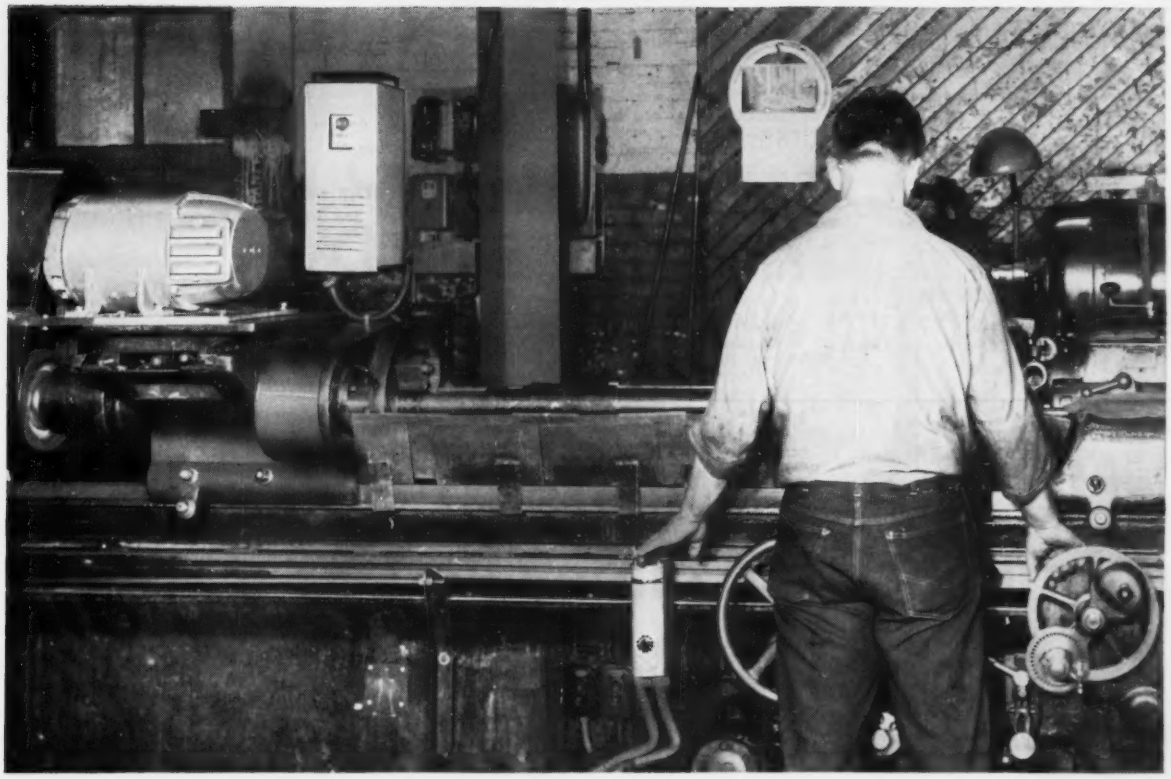
Barber-Colman Co., Rock and Montague, Rockford, Ill.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

GEAR CUTTING MACHINES, Spur and Helical Gears (Shaper or Planer Type)

Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.

(*Continued on page* 342)

For more information on products advertised, use Inquiry Card, page 243



THE RELIANCE V★S JR. DRIVE



The all-electric, adjustable speed drive that eliminates mechanical gear boxes, clutches and variable pitch cone pulleys. Ratings from ¾ to 3 Hp.

gives your operator the correct grinding speed instantly

Reliance V★S Jr. Drive offers an infinite selection of speeds which permits your operator to use the correct grinding speed.

And with the V★S Jr. Drive, speed changes can be made instantly by the simple turn of a dial. No time is lost changing belts to adjust for work diameters.

The Reliance V★S Jr. Drive is compact, simple to operate and economical to maintain. Its advantages are helping to increase production and lower costs in many industries.

Write for Bulletin D-2102. It contains all the facts and tells *how* . . . *when* . . . and where the V★S Jr. can serve you best.

D-1478-A

RELIANCE ELECTRIC AND ENGINEERING CO.

Sales Representatives in Principal Cities • 1077 Ivanhoe Road, Cleveland 10, Ohio

For more information on products advertised, use Inquiry Card, page 243

GEAR CUTTING MACHINES, Worm and Worm Wheels

Barber-Colman Co., Rock and Montague, Rockford, Ill.
Cone-Drive Gear Div., Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt. (Straight and Hourglass Types).
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

GEAR FINISHING MACHINES

Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.

GEAR GRINDING MACHINES

Cosa Corp. 405 Lexington Ave., New York 17.
Gear Grinding Machine Co., 3901 Christopher St., Detroit 11, Mich.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.
Pratt & Whitney, West Hartford 1, Conn.
Van Norman Co., Springfield, Mass.

GEAR HARDENING MACHINES

Gleason Works, 1000 University Ave., Rochester 3, N. Y.

GEAR LAPPING MACHINES

Fellows Gear Shaper Co., 78 Rover St., Springfield, Vt.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.

GEAR MOTORS

See Speed Reducers.

GEAR SHAVING MACHINES

Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.

GEAR TESTING MACHINERY

Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Brown & Sharpe Mfg. Co., Providence, R. I.
Eastman Kodak Co., Rochester, N. Y.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

GEARS, CUT

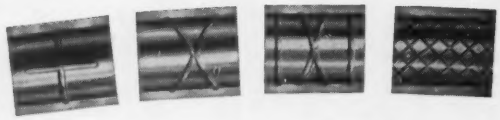
Automotive Gear Works, Inc., Richmond, Ind.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia, Pa.
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Brad Foote Gear Works, 1309 S. Cicero Ave., Cicero 50, Ill.
Braun Gear Co., 239 Richmond, Brooklyn 8, N. Y.
Cincinnati Gear Co., Wooster Pike and Mariemont Ave., Cincinnati, Ohio.
Cleveland Worm & Gear Co., 3249 E. 80th St., Cleveland, Ohio.
Cone-Drive Gears Div., Michigan Tool Co., 7200 E. McNichols Rd., Detroit, Mich.
Diefendorf Gear Corp., 920 N. Belden Ave., Syracuse, N. Y.
Fairfield Mfg. Co., 2309 S. Earl Ave., Lafayette, Ind.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Gear Specialties Inc., 2635 W. Medill Ave., Chicago 47, Ill.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Illinois Gear & Mch. Co., 2120 No. Natchez Ave., Chicago 35, Ill.
Mass. Gear & Tool Co., 36 Nassau St., Woburn, Mass.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Micron Gear Mfg. Co., 102-38 Corona Ave., Corona, N. Y.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 13, Mich.
New Jersey Gear Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Perkins Machine & Gear Co., West Springfield, Mass.
Philadelphia Gear Works, Erie Ave., and G St., Philadelphia, Pa.
Pittsburgh Gear Co., Neville Island, Pittsburgh 25, Pa.
Sier-Bath Gear & Pump Co., Inc., 9248 Hudson Blvd., North Bergen, N. J.
Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio.
Williamson Gear & Machine Co., 2606 Martha St., Philadelphia 25, Pa.

GEARS, Rawhide and Non-Metallic

Boston Gear Works, 3200 Main St., North Quincy, Mass.
Braun Gear Co., 239 Richmond, Brooklyn 8, N. Y.

(*Continued on page* 344)

High Speed
CONTINUOUS OIL GROOVING



500
PIECES PER HOUR!

High-production and economical operation are the features of the WICACO CONTINUOUS OIL GROOVER . . . capable of completing as many as 500 grooved pieces per hour in routine practice—even with unskilled labor!

The operator loads and unloads the work **without stopping the Machine**—a valuable time-saving advantage made possible by the WICACO upright construction of the spindle and stationary chuck. Feed-lever automatically returns to neutral position when cutting tool reaches its proper depth. The spindle—not the chuck—revolves, permitting fast and convenient grooving of a variety of larger and irregular work. Maximum depth of groove 7/32", maximum width 3/8", grooves may be cut in work from 1/4" I.D. to 4 1/2" I.D.; standard chuck holds work to 4½" O.D.; stroke of spindle from 0" to 7"; floor space 24" dia.; weight of machine about 950 lbs.



Send us sample bearings to cut to specifications. We will return them, properly grooved, with a record of the time required and a cost-estimate. No obligation. Or, write for detailed, well illustrated Bulletin.

WICACO

SINCE 1868

THE WICACO MACHINE CORPORATION

WAYNE JUNCTION PHILADELPHIA 44, PA.

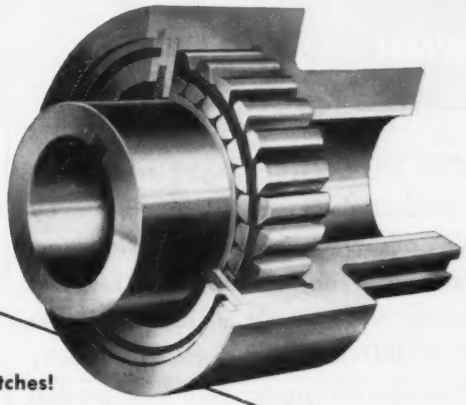
For more information on products advertised, use Inquiry Card, page 243

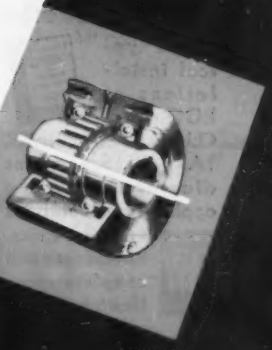
This is Modern Clutch Performance

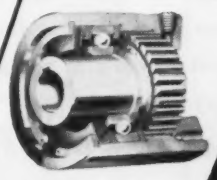
Check Your Present Clutches With These 5 Formsprag Advantages:

- Over-Running
- Indexing
- Backstopping

1. Instantaneous operation with no backlash.
2. Infinite number of gripping positions.
3. Maximum capacity—for size and weight.
4. Internal simplicity—easily serviced.
5. Long life because of low unit stresses at changing contact points.







No more Roller- or Ratchet-Type clutches!
Only the full complement sprag-type clutch measures up to today's performance standards.
FORMSPRAG IS THE ONLY FULL COMPLEMENT CLUTCH ON THE MARKET!
And *only* "full complement" gives you all 5 of these five performance advantages.

FORMSPRAG *Clutches*

For more interesting facts on the most modern clutch you can select, write for this folder today.



FORMSPRAG COMPANY, 23609 Hoover Road, Van Dyke, Michigan

DISTRIBUTORS IN PRINCIPAL CITIES

Cincinnati Gear Co., Wooster Pike and Marlemont Ave., Cincinnati, Ohio.
Diefendorf Gear Corp., 920 N. Belden Ave., Syracuse, N. Y.
Gear Specialties Inc., 2635 W. Medill Ave., Chicago 47, Ill.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Philadelphia Gear Works, Erie Ave., and G St., Philadelphia, Pa.
Pittsburgh Gear Co., Neville Island, Pittsburgh 25, Pa.
Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio.
Williamson Gear & Machine Co., 2606 Martha St., Philadelphia 25, Pa.

GENERATORS, Electric

General Electric Co., Schenectady 5, N. Y.
Lincoln Electric Co. (Arc), 22801 St. Clair Ave., Cleveland, Ohio.
Reliance Electric & Engrg. Co., 1074 Ivanhoe Rd., Cleveland 10, Ohio.

GRADUATING MACHINES

Abrasive Mch. Tool Co., Dexter Rd., E. Providence 14, R. I.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.

GREASE

Cities Service Oil Co., 70 Pine St., New York, N. Y.
Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Lubriplate Div., Fiske Bros. Refining Co., 129 Lockwood St., Newark 5, N. J.
Sinclair Refining Co., 600 5th Ave., New York, N. Y.
Standard Oil Co. (Indiana), 910 S. Michigan, Chicago, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia.
Texas Co., 135 E. 42nd St., New York, N. Y.

GRINDERS, Carbide Tool

See Grinding Mches, Carbide Tool

GRINDERS, Die and Mold

Consolidated Mch. Tool Corp., Rochester, N. Y.
Hammond Machinery Builders, Inc., 1600 Douglas Ave., Kalamazoo 54, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.

GRINDERS, Oilstone, for Woodworking Tools

Mummert-Dixon Co., Hanover, Pa.

GRINDERS, Pneumatic

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.
Keller Tool Co., Grand Haven, Conn.
Madison-Kipp Corp., Madison, Wis.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.

GRINDERS, Portable Electric and Toolpost

Black & Decker Mfg. Co., E. Penna. Ave., Towson, Md.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Hammond Machinery Builders, Inc., 1600 Douglas Ave., Kalamazoo 54, Mich.
Millers Falls Co., Greenfield, Mass.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

GRINDING FIXTURES

Amco Gage Co., 19760 W. 8 Mile Rd., Detroit 19, Mich.
Geometric Tool Co. (Die Chaser), Westville Station, New Haven 15, Conn.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GRINDING MACHINES, Abrasive Belt

Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Mattison Mch. Works, Rockford, Ill.
Walker-Turner Div., Kearney & Trecker Corp., 900 North Ave., Plainfield, N. J.
Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

GRINDING MACHINES, Bench

Black & Decker Mfg. Co., E. Penna. Ave., Towson, Md.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
Hammond Machinery Builders, Inc., 1600 Douglas Ave., Kalamazoo 54, Mich.
Hardinge Bros., Inc., 1418 College Ave., Elmira, N. Y.
Millers Falls Co., Greenfield, Mass.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Burke Machine Tool Div., Brotherton Rd. 17, Cincinnati 27, Ohio
Walker-Turner Div. Kearney & Trecker Corp., 900 North Ave., Plainfield, N. J.

GRINDING MACHINES, Broach

Colonial Broach Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.
Lapointe Mch. Tool Co., 34 Tower St., Hudson, Mass.

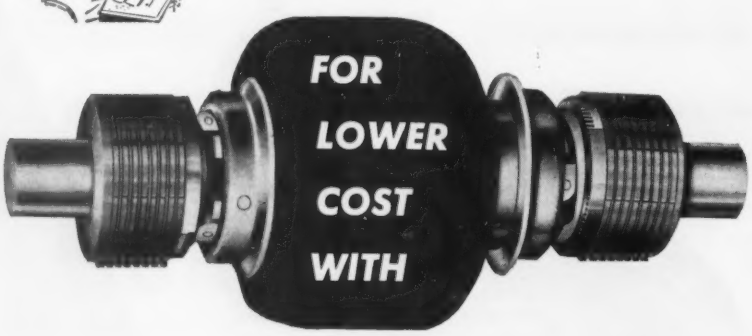
GRINDING MACHINES, Camshaft

Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.

(*Continued on page* 346)



DESIGN



Send for This Handy Bulletin



Shows typical installations of ROCKFORD CLUTCHES and POWER TAKE-OFFS. Contains diagrams of unique applications. Furnishes capacity tables, dimensions and complete specifications.

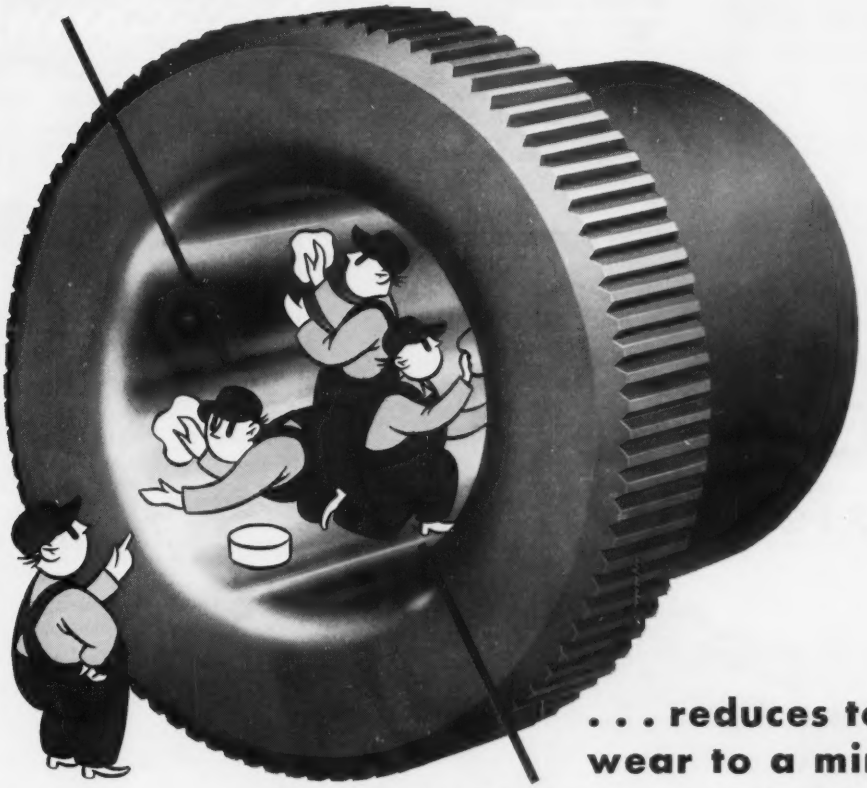
ROCKFORD CLUTCH engineers are helping product designers reduce costs — by making possible *quicker clutch installation, easier clutch adjustments,* and reducing *after-sale service* to a minimum. Because ROCKFORD CLUTCH precision, capacity and stamina are greater than ever, product owner's up-keep costs are lower. Now is the time to have ROCKFORD clutch engineers give *your* product the benefit of lower clutch cost plus competitive operating advantages.

ROCKFORD CLUTCH DIVISION
BORG-WARNER
410 Catherine Street, Rockford, Illinois

ROCKFORD CLUTCHES

For more information on products advertised, use Inquiry Card, page 243

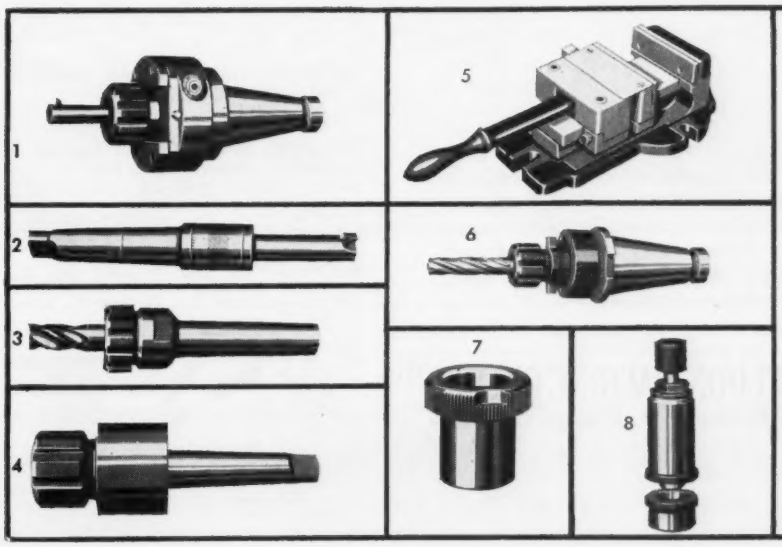
SUPER FINISH OF UNIVERSAL DRILL BUSHINGS . . .



. . . reduces tool wear to a minimum

One sure way to cut excessive tool wear in your operations is to specify Universal Drill Bushings because their superfinish bores help reduce wear on production tools to an absolute minimum, especially in close tolerance work. The blended radius on the top inside diameter helps prevent tool hang-up and breakage. 100% concentricity and hardness tests insure accuracy, uniform high quality and long life. Knurled heads provide a quick, sure grip. Universal Drill Bushings are produced in a complete range of standard sizes and lengths. Orders for special dimensions will receive prompt attention. For complete information, write to the office nearest you—Universal Engineering Sales Co., 1060 Broad St., Newark 2, N.J.; 5035 Sixth Ave., Kenosha, Wis.—or our home office.

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UNIVERSAL ENGINEERING COMPANY

FRANKENMUTH 2
MICHIGAN

(1) BORING CHUCK
(2) MIKRO-LOK BORING BAR
(3) STANDARD COLLET CHUCK
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(5) WEDGE-LOCK PRODUCTION VISE
(6) "KWIK-SWITCH" TOOL HOLDER
(7) STANDARD DRILL BUSHING
(8) UNIVERSAL INDEX PLUNGER

GRINDING MACHINES, Carbide Tool

Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hammond Machinery Builders, Inc., 1600 Douglas Ave., Kalamazoo 54, Mich.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

GRINDING MACHINES, Centerless

Cincinnati Grinders, Inc., Cincinnati, Ohio.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Landis Tool Co., Waynesboro, Pa.
Van Norman Co., Springfield, Mass.

GRINDING MACHINES, Chucking

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Bryant Chucking Grinder Co., 257 Clinton St., Springfield, Vt.
Bullard Co., Brewster St., Bridgeport, Conn.
Landis Tool Co., Waynesboro, Pa.

GRINDING MACHINES, Crankshaft

Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.

GRINDING MACHINES, Cylindrical

Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Grinders, Inc., Cincinnati, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Frauenthal Div., Kaydon Engineering Corp., Muskegon, Mich.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Landis Tool Co., Inc., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Rivett Lathe & Grinder Inc., Brighton, Boston 35, Mass.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Van Norman Co., 2640 Main St., Springfield 7, Mass.

GRINDER MACHINES, Die Chaser

Eastern Mch. Screw Corp., New Haven, Conn.
Landis Machine Co., Waynesboro, Pa.

GRINDING MACHINES, Disc

Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Hammond Machinery Builders, Inc., 1600 Douglas Ave., Kalamazoo 54, Mich.
Mattison Machine Works, Rockford, Ill.

GRINDING MACHINES, Drill

Blake, Edward Co., 442 Cherry St., West Newton 65, Mass.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Gailmeyer & Livingston Co., 336 Straight Ave., S. W. Grand Rapids 4, Mich.
Hammond Machinery Builders, Inc., 1600 Douglas Ave., Kalamazoo 54, Mich.
Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Union Twist Drill Co., Athol, Mass.

GRINDING MACHINES, Face

Abrasive Mch. Tool Co., Dexter Rd., E. Providence 14, R. I.
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Columbia Div., Lodge & Shipley Co., Hamilton 1, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Mattison Machine Works, Rockford, Ill.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.

GRINDING MACHINES, Flexible Shaft

See Flexible Shaft Equipment

GRINDING MACHINES, Gap

Cincinnati Grinders, Inc., Cincinnati, Ohio.
Landis Tool Co., Waynesboro, Pa.

GRINDING MACHINES, Gear Tooth

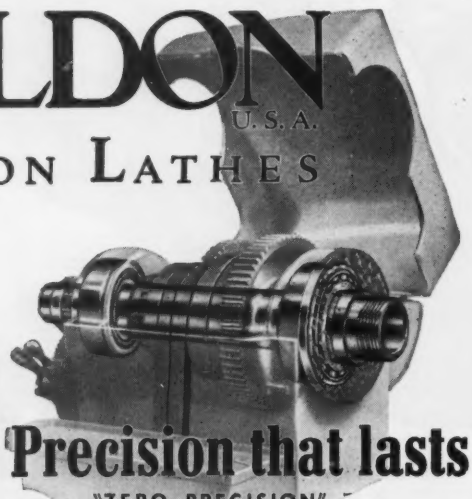
See Gear Grinding Machines

GRINDING MACHINES For Sharpening Cutters, Reamers, Hobs, Etc.

Barber-Colman Co., Rock and Montague, Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Mch. Co., Cincinnati, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gailmeyer & Livingston Co., 336 Straight Ave., S. W. Grand Rapids 4, Mich.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Landis Tool Co., Waynesboro, Pa.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.

(*Continued on page* 348)

SHELDON
CHICAGO U.S.A.
PRECISION LATHES



SHELDON
"Stamina" Features:

- Rigid, Heavily cross-strutted 1-piece Beds—2 V-ways, 2 Flat ways
- Full Double-Walled Aprons—all gear shafts supported on both ends.
- Heavy Carriage with wide bearing on bed.
- Twin V-Belts to Spindle for extra power.



Precision that lasts
. . . "ZERO PRECISION" TAPER ROLLER BEARINGS

No lathe can be more accurate than its spindle bearings. Hence before buying any lathe one should check the *exact* type and tolerances of bearings used.

The No. TS-56B (and several other) SHELDON Precision Lathes have "Zero Precision" Taper Roller Bearings, held to tolerances of .00015". Not only are these the most accurate bearings used in any lathe, they are the sturdiest type . . . hold their accuracy thru long hard use . . . hold it even under abuse. With the other stamina features built into SHELDON Precision Lathes, they assure continued accuracy, without costly maintenance, thru years of hard service.

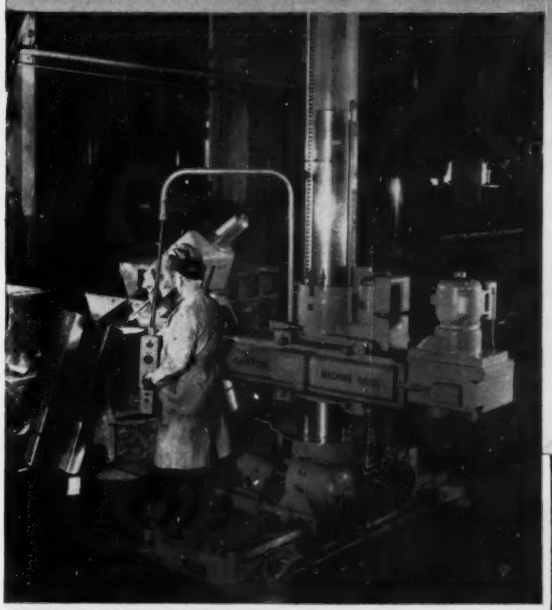
Write for Catalog

SHELDON MACHINE CO., INC.
4246 N. Knox Ave., Chicago 41, Illinois

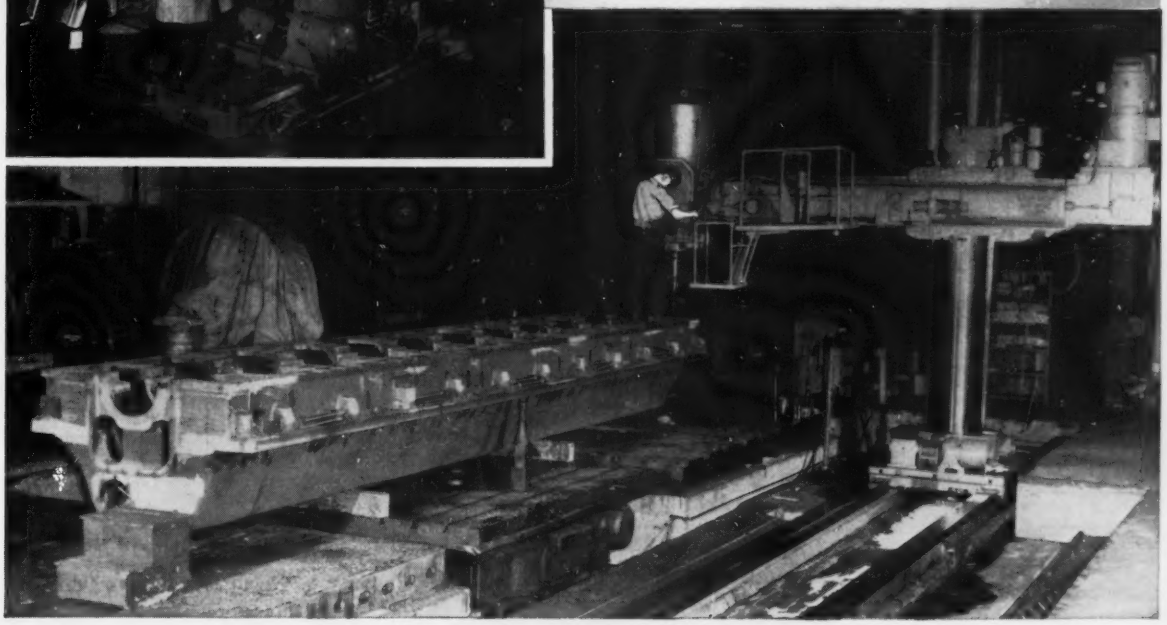
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Kaukauna At Work....

UNIVERSAL RADIAL DRILLING MACHINES



Drilling angular holes in bore of casting is a job that requires accuracy, fast tool positioning and plenty of power to take full advantage of the highest feeds and speeds permissible with modern cutting tools. Kaukauna Universal Radial Drills have the power, accuracy and stamina to do this work quickly, easily and at low cost. A versatile line of machines with simplified controls, they maintain efficient high production on large, unwieldly workpieces or small production parts, and perform drilling, reaming, boring, counterboring, tapping and spot-facing operations. They do jobs that no other machines can do . . . save time and money.



With extended column, runway and reach, this Kaukauna Universal Radial Drilling Machine is saving set-up time by drilling, tapping, driving studs and spot-facing with speed and accuracy from any angle on diesel engine bases and blocks.

Kaukauna builds Universal Radial Drills and Horizontal Drilling Machines in a range of sizes which meet practically all requirements in modern production practice. Write today for descriptive catalog or ask representative to call.

KMC Kaukauna MACHINE CORPORATION

KAUKAUNA, WISCONSIN, U. S. A.

Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.
Pratt & Whitney, West Hartford 1, Conn.
Thompson Grinder Co., 1500 W. Main St., Springfield, Ohio.
Union Twist Drill Co., Athol, Mass.

GRINDING MACHINES, For Sharpening Turning and Planing Tools

Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hammond Machinery Builders, Inc., 1600 Douglas Ave., Kalamazoo 54, Mich.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
South Bend Lathe Works Inc., 425 E. Madison St., South Bend, Ind.
Walker, O. S., Co., Inc., Worcester Mass.
Waltham Machine Works, Newton St., Waltham, Mass.

GRINDING MACHINES, Internal

Abrasive Mch. Tool Co., Dexter Rd., E. Providence 14, R. I.
Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass.
Bryant Chucking Grinder Co., 257 Clinton St., Springfield, Vt.
Columbia Div., Lodge & Shipley Co., Hamilton 1, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit, 32, Mich.
Frauenthal Div., Kaydon Engineering Corp., Muskegon, Mich.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Rivett Lathe & Grinder Inc., Brighton, Boston 35, Mass.
Wicaco Machine Corp., Stenton Ave. and Louden St., Philadelphia, Pa.

GRINDING MACHINES, Jig

Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Moore Special Tool Co., Inc., 724 Union Ave., Bridgeport, Conn.
Pratt & Whitney, West Hartford 1, Conn.

GRINDING MACHINES, Knife and Shear Blade

Abrasive Mch. Tool Co., Dexter Rd., E. Providence 14, R. I.
Columbia Div., Lodge & Shipley Co., Hamilton 1, Ohio.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Mattison Machine Works, Rockford, Ill.
United States Electrical Tool Div., Emerson Elec. Mfg. Co., 1050 Findlay St., Cincinnati 14, Ohio.

GRINDING MACHINES, Piston Ring

Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Lehmann Machine Co., 3560 Chouteau Ave., St. Louis, Mo.
Mattison Machine Works, Rockford, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.

GRINDING MACHINES, Profile

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Cleveland Grinding Machine Co., 1643 Eddy Rd., Cleveland 12, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Sheffield Corp., 721 Springfield, Dayton, Ohio.

GRINDING MACHINES, Ring Wheel Ball Race, Etc.

Frauenthal Div., Kaydon Engineering Corp., Muskegon, Mich.
Landis Tool Co., Waynesboro, Pa.
Van Norman Co., Springfield, Mass.

GRINDING MACHINES, Radial

Columbia Div., Lodge & Shipley Co., Hamilton 1, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

GRINDING MACHINES, Radius, Link

Besly-Welles Corp., Beloit, Wis.
Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Mattison Machine Works, Rockford, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.

GRINDING MACHINES, Roll

Farrel-Birmingham Co., 25 Main St., Ansonia Conn.
Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.

GRINDING MACHINES, Spline Shaft

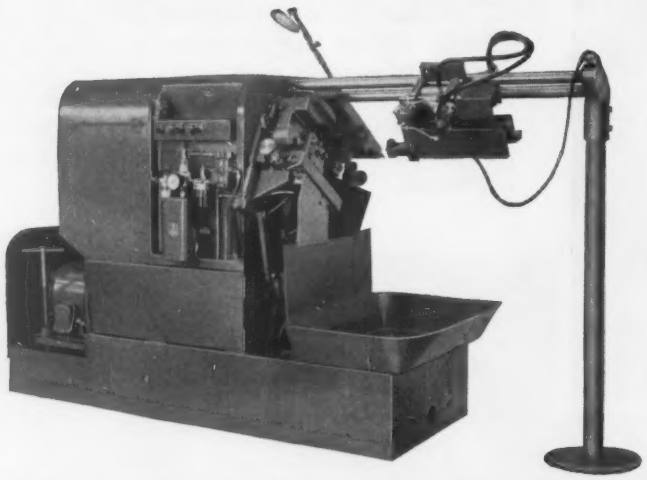
Van Norman Co., Springfield, Mass.

GRINDING MACHINES, Surface

Abrasive Mch. Tool Co., Dexter Rd., E. Providence 14, R. I.
Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass. (Rotary)
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Blanchard Machine Co., 64 State St., Cambridge, Mass.

(*Continued on page* 352)

The NEW MODERN AUTOMATIC
CUTTING-OFF MACHINE



Cuts Off Tubing, Pipe and Shafting . . . FAST

Cuts off longer pieces than a regular automatic machine. In fact, cuts off *any length you want*—and cuts it *faster*. If your production *requires* quantity cutting-off of tubing, pipe or shafting, check the figures below against your present time.

1/2" Tubing

This machine cuts off and chamfers both outside edges of ½" .030 wall tubing, 5" long at the rate of one every 2.5 seconds.

1 1/4" Cold Rolled

This machine cuts off and chamfers both ends of 1¼" cold rolled, 20" long, at the rate of one every 20 seconds.

1" Tubing

This machine cuts off and chamfers both outside edges of 3" long, at the rate of one every 3 seconds.

These popular, time saving machines are now available in four sizes, handling work up to 6¾" O.D. Their many cost cutting features are described and illustrated in our latest catalog that will be mailed promptly on request.

4" Threaded Studs



Cut and chamfered at one time—in 8 seconds—from 10 ft. length of stock already threaded. (¾" U. S. Standard.) Clean cut. Clean chamfer. Nuts start easily, with no extra finishing required.

WRITE FOR ILLUSTRATED CATALOG.

MODERN MACHINE TOOL CO.
Jackson, Michigan

For more information on products advertised, use Inquiry Card, page 243

How the use of NATIONAL Seamless EXTRUDED Stainless Tubing *cuts nut manufacturing costs*



USING NATIONAL Seamless EXTRUDED USS Stainless (type 303) Tubing, the Tri-Clover Division of Ladish Corporation is now turning out hexagonal nuts in less time and at lower cost than they could using solid bar stock. The savings in material cost alone amounts to 11.77 cents per piece.

All machining on the nuts, except threading and O.D. finishing, is done in one operation on a 6-spindle, 3½ inch Conomatic automatic machine. A saving of five seconds in the time cycle was made by using the extruded hexagonal stock versus bar stock. The use of hex tubing has eliminated the cost and upkeep of boring tools —and, because tubing is considerably lighter than bar stock, it can be handled faster and with less difficulty.

NATIONAL EXTRUDED Tubing offers you high strength, uniformity, and dependability that only *seamless* tubing can give. For a better precision part, involving fewer operations and fewer machine hours, investigate NATIONAL Seamless EXTRUDED Tubing—made by the world's largest manufacturer of tubular steel products. Feel free to call our engineers if you'd like help in applying NATIONAL Seamless to your product.

* * *

National Tube employs a hot-extrusion process known as "Sejournet" in which white-hot billets of steel are squeezed into tubing of various shapes by a 2,500-ton hydraulic press and ram—a manufacturing method that insures absolute uniformity of wall strength.

NATIONAL TUBE DIVISION
UNITED STATES STEEL CORPORATION, PITTSBURGH, PA.
(Tubing Specialties)

COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO
PACIFIC COAST DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

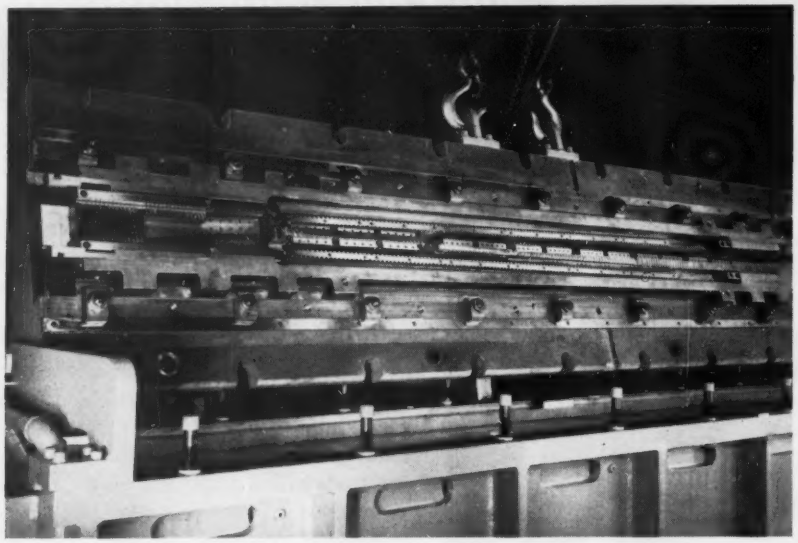
USS TRADE MARK **NATIONAL Seamless EXTRUDED TUBING**

WALLS WITHOUT WELDS

UNITED STATES STEEL

Here's the exciting story about a **BROACHING MACHINE**

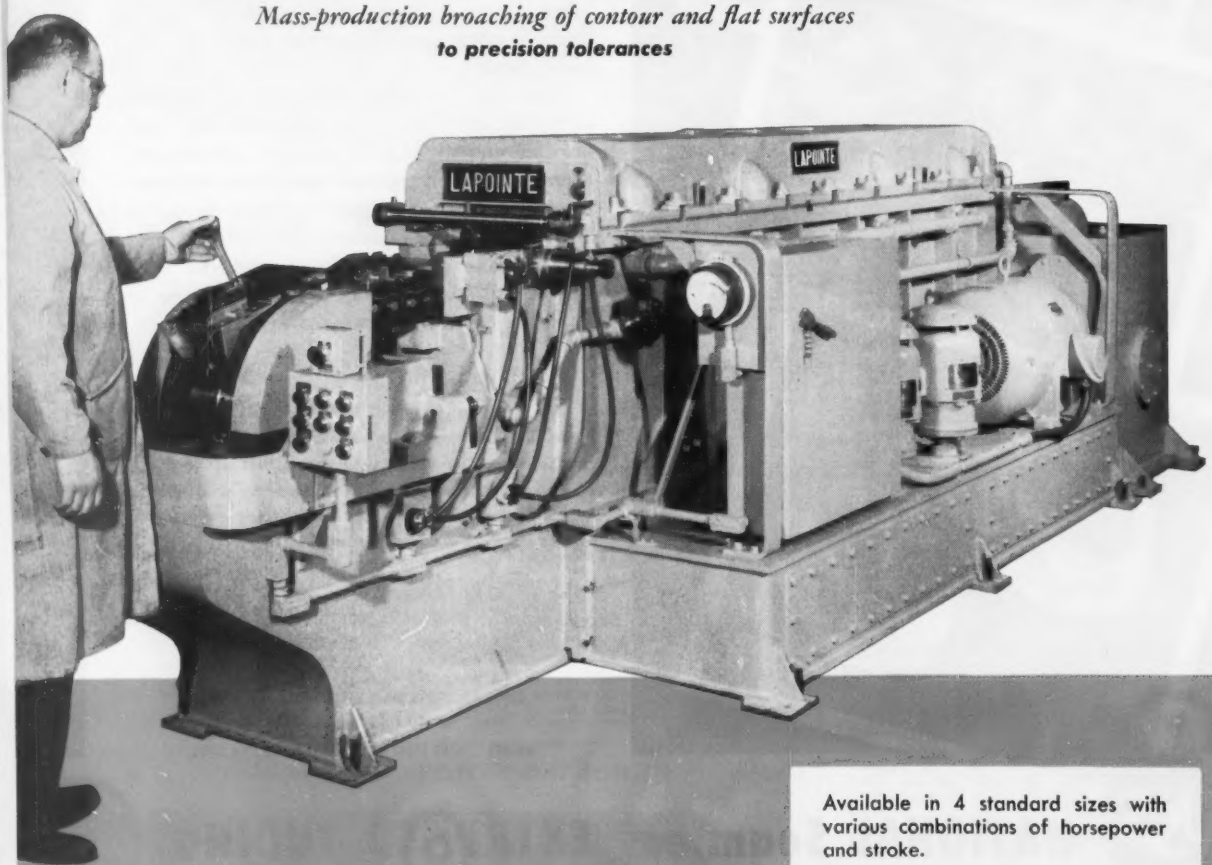
the LAPOINTE



THE BONNET,
or broach-carrying cover, is hinged to the frame and accommodates the main broach assemblies.

Observation Ports
enable the operator to see the condition of the broaches in action.

Mass-production broaching of contour and flat surfaces
to precision tolerances



Available in 4 standard sizes with various combinations of horsepower and stroke.

that DOESN'T STOP!

CONTINUOUS BROACHING MACHINE

- **RUNS ALL THE TIME**

  . . . you don't stop it to index
  . . . you don't stop it to feed
  . . . you don't stop it at all
  (it's the nearest thing to perpetual motion!)

- **THE PARTS MOVE — NOT THE BROACH!**

  A powerful, matched-twin-chain drive is fitted with a series of individual fixtures (*designed by Lapointe*) that are completely automatic: self-operating, self-locating, self-clamping, and self-releasing. The operator merely drops the parts into the work nests.

- **FABULOUS PRODUCTION IS POSSIBLE**

  For instance, production of more than 1400 automotive connecting rods per hour has been maintained, broaching the sides, joint face, and half-round. 1400 . . . 1700 . . . 2000 parts per hour can be broached under full automation, with the optional hopper feed. What can this mean *for you*, on parts that you are *not now broaching*? Here is *precision* with *production*, and the great advantage of *machined surfaces!*

• • • •

Exceptionally heavy and rigid design assures smooth operation, long tool life, and excellent broaching finish. Completely fool-proof, the machine will stop automatically if parts are incorrectly positioned in manual loading.

FEATURES

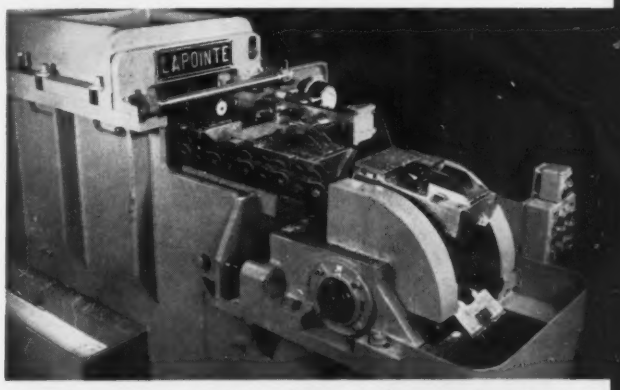
Engineered for ease of loading.

Broached part automatically releases at rear of machine onto suitable conveyor.

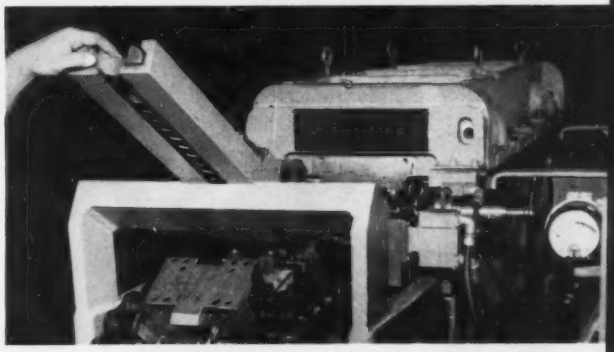
Multiple speeds. Changes in pick-off gears can easily and quickly be made.

Plus: Electric brake, for instant stopping; segmented sprocket, for simplified maintenance; two individual coolant pumps, for dependable flow; shear pin coupling, in convenient location.

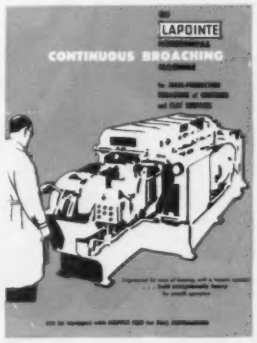
LAPOINTE does the whole job! We assume 100% responsibility because we build the machines, tools, and fixtures!



Front of machine, showing safety stop (the round white disc under Lapointe name-plate.) This safety stop assures positive positioning of parts in fixture. Note accessible chip trough.



Lends itself to **FULL AUTOMATION** when equipped with hopper feed.



Get precision results at reduced costs!

Every plant that is now mass-producing parts should investigate the Lapointe Continuous Broaching Machine with its many superior advantages. Send for descriptive bulletin CH-1.

THE LAPOINTE MACHINE TOOL COMPANY
HUDSON, MASSACHUSETTS • U. S. A.
In England: Watford, Hertfordshire

THE WORLD'S OLDEST AND LARGEST MANUFACTURERS OF BROACHING MACHINES AND BROACHES

Brown & Sharpe Mfg. Co., Providence, R. I.
Columbia Div., Lodge & Shipley Co., Hamilton 1, Ohio.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Frauenthal Div., Kaydon Engineering Corp., Muskegon, Mich.
Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Gollmeyer & Livingston Co., 336 Straight Ave., S. W., Grand Rapids 4, Mich.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Mattison Machine Works, Rockford, Ill.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Pratt & Whitney, West Hartford 1, Conn.
Reid Bros. Co., Inc., Beverly, Mass.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Thompson Grinder Co., 1500 W. Main St., Springfield, Ohio.
Walker, O. S., Co., Inc., Worcester Mass.

GRINDING MACHINES, Tap

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.

GRINDING MACHINES, Thread

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
Landis Machine Co. (Centerless), Waynesboro, Pa.
Sheffield Corp., 721 Springfield, Dayton, Ohio.

GRINDING MACHINES, Universal

Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Grinders, Inc., Cincinnati, Ohio.
Frauenthal Div., Kaydon Engineering Corp., Muskegon, Mich.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.

GRINDING MACHINES, Worm

Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
Pratt & Whitney, West Hartford 1, Conn.

GRINDING WHEELS

Blanchard Machine Co., 64 State St., Cambridge, Mass.
Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
Cincinnati Milling Products Div., Cincinnati Milling Machine Co., Cincinnati, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Gardner Machine Co. (Surface Grinder), 414 E. Gardner St., Beloit, Wis.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Simonds Abrasive Co., Tacony and Fraley Sts., Bridesburg, Philadelphia, Pa.
Smit, J. K. & Sons, Inc., Murray Hill, N. J.

GROOVE PINS

Gillen, John, Co. Inc., 2540 S. 50th Ave. Cicero 50, Ill.

GROOVING TOOLS, Internal

Waldes Kohinoor, Inc., 4716 Austel Place, Long Island City 1, N. Y.

HAMMERS, Drop

Bliss, E. W. Co., 1375 Raff Rd., S. W. Canton, Ohio.
Chambersburg Engrg. Co., Chambersburg, Pa.
Erie Foundry Co., Erie, Pa.
Morgan Engrg. Co., Alliance, Ohio.

HAMMERS, Forging Air

Chambersburg Engrg. Co., Chambersburg, Pa.
Lobdell United Co., 200 "G" St., Wilmington 99, Del.

HAMMERS, Pneumatic

Chambersburg Engrg. Co., Chambersburg, Pa.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.
Keller Tool Co., Grand Haven, Mich.

HAMMERS, Portable Electric

Black & Decker Mfg. Co., E. Penna. Ave., Towson, Md.
Millers Falls Co., Greenfield, Mass.

HAMMERS, Power

Chambersburg Engrg. Co., Chambersburg, Pa.
Lobdell United Co., 2000 "G" St., Wilmington 99, Del.

HAMMERS, Shaft

S K F Industries, Inc., P. O. Box 6731, North Philadelphia, Pa.
Standard Pressed Steel Co., Jenkintown, Pa.

HAMMERS, Soft

Chambersburg Engrg. Co., Chambersburg, Pa.
Erie Foundry Co., Erie, Pa.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

(*Continued on page 354*)



counterbores

There's something "special" about GAIRING Standard Counterbores . . . they are built and backed by the company which designed them. They're offered in HSS and TC-tipped up to 5" dia., of highest workmanship and quality materials. They're the best you can buy, accurate and dependable, the kind your shop can't afford to be without. Write for the Standard Catalog today.

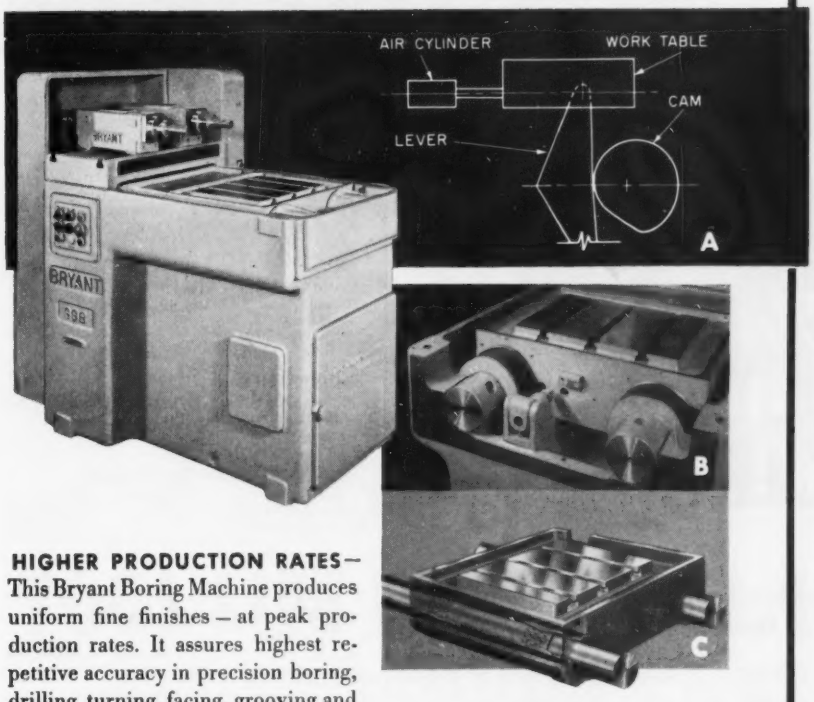
In Canada: A. C. Wickman (Canada) Ltd., Queensway, Toronto 14

The GAIRING Tool Company

21225 Hoover Road **Detroit 32, Mich.**

For more information on products advertised, use Inquiry Card, page 243

A new approach to
...PRECISION BORING



HIGHER PRODUCTION RATES—This Bryant Boring Machine produces uniform fine finishes – at peak production rates. It assures highest repetitive accuracy in precision boring, drilling, turning, facing, grooving and contour boring and turning.

The table is actuated by a simple cam and lever unit **A** which provides positive control of the cycle at all times. This mechanical actuation eliminates variation in the cycle due to temperature change.

FINER FINISHES—The Bryant 998 provides the smooth, uniform table motion so essential in generating a fine finish with a single point tool. The table moves on two 4" diameter solid steel slide bars **B** firmly bolted to the bed. The table is supported by two anti-friction preloaded ball bearings on each of these bars. This construction provides a metal-to-metal contact which eliminates shifting due to an oil film **C**.

MINIMUM DOWN-TIME—The Bryant 998 requires minimum servicing – motors, boring heads and slides are permanently grease sealed. Every unit is easily accessible.

SPECIFICATIONS—Total table stroke: 6"; Top of table to top of bridge: 4"; Width of bridge: 27 3/8"; Multiple boring heads as required by tooling to a maximum of 4 (209) heads; Boring head motor: 5HP; Table dimensions: 17½" x 22"; Floor space (without coolant tank): 31" x 54".

Write today for complete details!

BRYANT Chucking Grinder Co.
SPRINGFIELD, VERMONT, U. S. A.

Internal Grinders • Boring Machines
Internal & External Thread Gages • Granite Surface Plates

20 REASONS WHY...

- Bed, bridge, table and heads are normalized Meehanite castings.
- Cam actuated table moves on preloaded ball slide bars.
- Cam is hardened and ground.
- Boring head spindles rotate in preloaded ball bearings.
- Air cylinder opposes the work table motion directly with constant pressure and keeps the cam follower roll and the cam always in contact.
- Boring head drive is completely accessible.
- Cam drive assembly is protected by a torque limiting clutch.
- Cycle time is controlled by precision change gears in the cam drive gear box.
- Pad is provided at the rear for mounting accessory equipment.
- Push button controls are conveniently located.
- Manual, semi-automatic or fully automatic cycle.
- Emergency stop button instantaneously interrupts the cycle.
- Jog buttons on both front and rear of the machine for setup purposes.
- Machined setup pads are provided on the bridge for ease in locating fixtures.
- Maintenance is necessary at only three points: two grease fittings on the cam follower assembly and cleaning and filling of the filter-lubricator unit in the pneumatic system.
- Ball slide table is grease sealed.
- Gear box has its own closed lubrication system.
- Boring head bearings are permanently grease sealed.
- Cam is easily accessible for changing the table stroke.
- Change gears are enclosed in their own wet sump, splash lubrication system.

HARDENING EQUIPMENT
Gleason Works, 1000 University Ave., Rochester, N. Y.
Ohio Crankshaft Co., 3800 Harvard Ave., Cleveland, Ohio.

HARDENING MACHINES, Flame
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Gleason Works, 1000 University Ave., Rochester, N. Y.

HARDNESS TESTING INSTRUMENTS
Olsen, Tinius, Testing Mch. Co., Philadelphia, Pa.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Shore Instrument & Mfg. Co., Van Wyck Ave., and Carll St., Jamaica, N. Y.
Wilson Mechanical Instrument Co., Inc., 230-D Park Ave., New York, N. Y.

HEADING MACHINES
National Machinery Co., Greenfield and Stanton Sts., Tiffin, Ohio.

HOBBING MACHINES
See Gear Cutting Machines, Spur and Helical Gears (Hobbing), and Gear Cutting Machines, Worm and Worm Wheels.

HOBS
Barber-Colman Co., Rock and Montague, Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Hanson-Whitney Co., Div., Whitney Chain Co., Hartford, Conn.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.
National Twist Drill & Tool Co., Rochester, Mich.
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Union Twist Drill Co., Athol, Mass.

HOIST HOOKS
Bethlehem Steel Co., Bethlehem, Pa.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

HOISTING AND CONVEYING EQUIPMENT
Cleveland Crane & Engrg. Co., Wickliffe, Ohio.

HOISTS, Air
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.
Keller Tool Co., Grand Haven, Mich.

HOISTS, Chain, Etc.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.

HOISTS, Electric
Philadelphia Gear Works Inc., Erie Ave. and G St., Philadelphia, Pa.

HONING MACHINES, External
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Fulmer, C. Allen, Co., 1231 First National Bank Bldg., Cincinnati 2, Ohio.
Micromatic Hone Corp., 8100 Schoolcraft, Detroit 4, Mich.

HONING MACHINES, Internal (Cylinder)
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Fulmer, C. Allen, Co., 1231 First National Bank Bldg., Cincinnati 2, Ohio.
Micromatic Hone Corp., 8100 Schoolcraft, Detroit 4, Mich.
Moline Tool Co., 102 20th St., Moline, Ill.
Synder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.

HONING STONES
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
Fulmer, C. Allen, Co., 1231 First National Bank Bldg., Cincinnati 2, Ohio.
Moline Tool Co., 102 20th St., Moline, Ill.
Norton Co., 1 New Bond St., Worcester 6, Mass.

HONING TOOLS AND FIXTURES
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Fulmer, C. Allen, Co., 1231 First National Bank Bldg., Cincinnati 2, Ohio.
Micromatic Hone Corp., 8100 Schoolcraft, Detroit 4, Mich.

HOSE, Leather, Rubber, Metallic, Etc.
American Metal Hose Br. American Brass Co., 25 Broadway, New York, N. Y.
Norgren, C. A., Co., Inc., 3419 S. Elati St., Englewood, Colo.

HYDRAULIC MACHINERY Tools and equipment
American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Barnes, John S., Corp., Rockford, Ill.
Bethlehem Steel Corp., Bethlehem, Pa.

(*Continued on page* 356)

REPLACE *Obsolete* TAPPING HEADS NOW!



Modern Procunier Tappers are Streamlining Production Methods . . . Everywhere!



New Exclusive "Tru-Grip" Tap Holder

If you are now using ancient, troublesome tapping equipment, you are needlessly increasing operating costs, seriously impairing production and adding to your maintenance expense. Out-of-date, over-used models are incapable of attaining the streamlined efficiency that modernized industry is demanding. Progressive industrial users who recognize the need for high speed, accuracy and efficiency, are turning to Procunier Tappers as the solution to their steadily mounting production and spoilage costs. Procunier Tappers invariably produce more pieces per hour with fewer rejections, fewer spoiled pieces and a minimum of broken taps.

Designed for today's tough production conditions, they incorporate many unique and exclusive construction and operating features. Best of all, they're made to "take it" and provide you with many more profitable "operating hours" and less costly down time interruption.

Procunier tapping heads are priced low enough to make it economically possible to rid your plant of obsolete tapping heads NOW!

Write for FREE Brochure

giving full details, specifications, diagrams and work drawings on the complete line of Procunier tapping heads and accessories. See how they can fit into your present plant pattern.



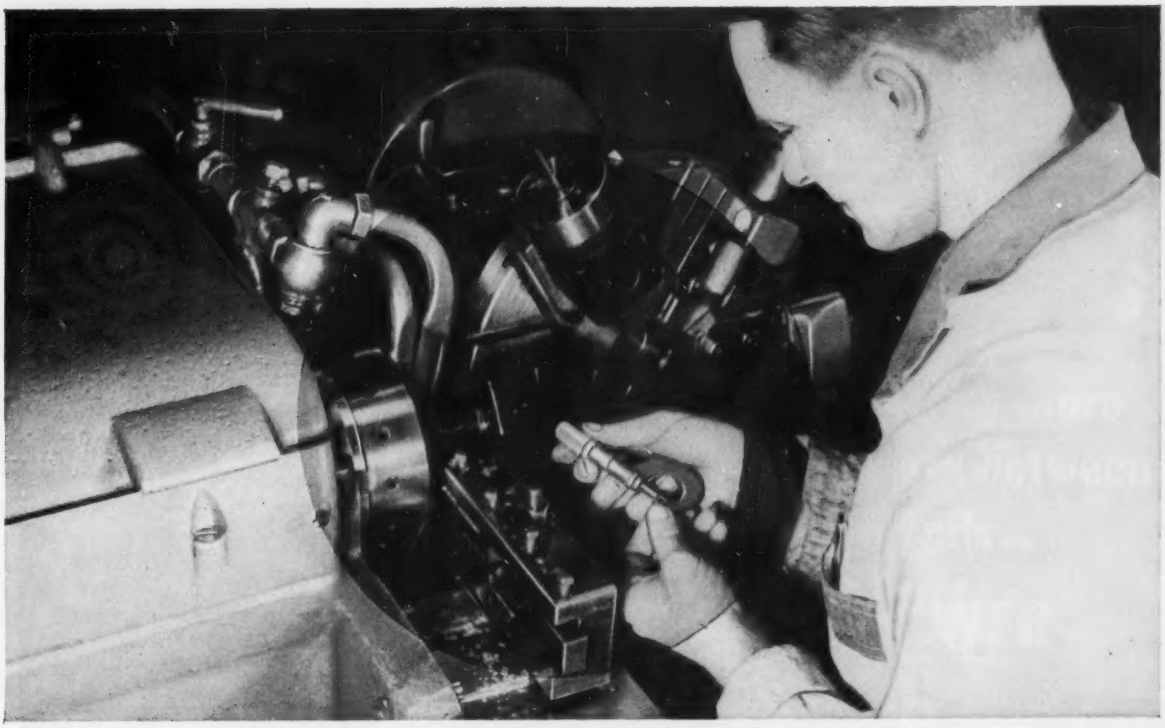
Procunier
Safety Chuck Company
16 S. CLINTON ST., CHICAGO 6, ILL.

PROCUNIER SAFETY CHUCK CO.
16 S. Clinton St., Chicago 6, Ill. Dept. 9

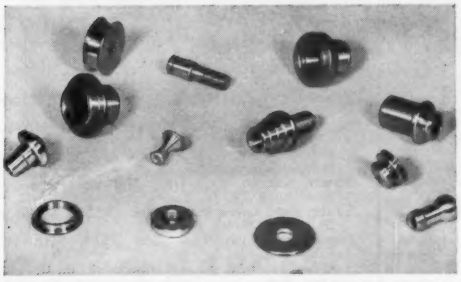
Gentlemen: Please send your illustrated brochure giving complete details, specifications and prices on the Tap King and your complete line of tapping attachments.

Name .....
Address .....
City ..... Zone ... State .....

For more information on products advertised, use Inquiry Card, page 243



TOOL LIFE INCREASED 40% USING CITIES SERVICE CUTTING OIL



ONE OIL FOR ALL? After poor results with many cutting oils, the Dunbar Machine & Tool Company discovered all their cutting jobs could be done to perfection using only one oil . . . Cities Service Chilio #44.



NO EYE STRAIN. In addition to a 40% increase in tool life, owner Robert Dunbar found that the transparent characteristics of Chillo #44 help eliminate eye strain. Cutting operation is easily visible to operator.

Production Also Up, Reports Dunbar Machine & Tool Co.

THE PROBLEM . . . The Dunbar Machine & Tool Company had a problem. It seemed impossible to find one oil which would perform economically and efficiently for ALL the jobs required of the firm's automatic screw machines.

THE SOLUTION . . . After trying many brands of cutting oil, "none of which gave good all-round performance," owner Robert Dunbar called in a Cities Service engineer. After careful analysis of the problem, the engineer recommended Chillo #44 cutting oil.

THE RESULTS . . . Using Chillo #44, the company observed these results: Tool life increased nearly 40% . . . Production increased accordingly . . . Additional savings realized due to chip draining characteristics of oil . . . Holding tolerances no longer any problem . . . Machine clean-up time now insignificant . . . Transparency of oil eliminates eye-strain . . . Less smoke and fumes at high speeds . . . Also excellent for lubricating purposes. Says Mr. Dunbar, "Our results with Chillo #44 permit us to heartily endorse this product."

If you have a cutting oil problem, consult your nearest Cities Service representative or write Cities Service Oil Company, Sixty Wall Tower, New York 5, N. Y.

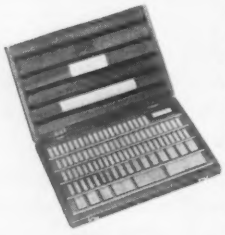
CITIES SERVICE

QUALITY PETROLEUM PRODUCTS

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Save time in gaging large dimensions with this new Ellstrom "Build-Up" Set!





What a time-saver this Ellstrom "Build-Up" Set is when it comes to checking large dimensions to millionths of an inch accuracy! And versatile, too. Six round gage blocks in step series from one to six inches, plus a standard base one-inch high. To use, just select the right combination of blocks and wring them together on the 4" diameter base. Then add standard square or rectangular gage blocks to establish the exact decimal dimensions desired! It's quick, easy, accurate . . . with far less chance of error, and none of the normal hazards encountered in building up large combinations with regular gage blocks. Won't topple over in use . . . and if accidentally knocked over, blocks are held in rigid combination by internal locking screws. Ideal for surface plate checking, setting visual gages or amplifiers, as well as for checking work on planers and horizontal boring mills. And each block is backed by the traditional heritage of Ellstrom . . . *measuring in millionths for three generations.*

Upon Request—New fact-filled catalog containing complete specifications and prices on the entire Ellstrom Standards line. Send for it today!



ELLSTROM STANDARDS DIVISION
Dearborn Gage Company, 22035 Beech Street, Dearborn, Michigan
Originators of Chromium Plated Gage Blocks

REPRESENTATIVES IN PRINCIPAL CITIES THROUGHOUT THE UNITED STATES AND CANADA

Birdsboro Steel Fdry. & Mch. Co., Birdsboro, Pa.
Bliss, E. W., Co., 1375 Raff Rd., S. W., Canton, Ohio.
Chambersburg Engrg. Co., Chambersburg, Pa.
Colonial Broach Co., P.O. Box 37, Harper Sta., Detroit 13, Mich.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Denison Engrg. Co., 1160 Dublin St., Columbus 16, Ohio.
Farquhar, A. B., Div. Oliver Corp., 142 North Duke St., York, Pa.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Hanson-Whitney Co., Div., Whitney Chain Co., Hartford, Conn.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4, Wis.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Vickers, Inc., 1402 Oakman Blvd., Detroit, Mich.
Watson-Stillman Co., Div., H. K. Porter Co., Inc., Roselle, N. J.
Wilson, K. R., 213 Mill St., Arcade, N. Y.

HYDRAULIC POWER UNITS OR TOOL HEADS

Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, John S., Corp., Rockford, Ill.
Barnes W. F. & John Co., 201 S. Waterford St., Rockford, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.

INDEXING AND SPACING EQUIPMENT

Abrasive Mch. Tool Co., Dexter Rd., E. Providence 14, R. I.
Brown & Sharpe Mfg. Co., Providence, R. I.
Engis Equipment Co., 431 S. Dearborn St., Chicago 5, Ill.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Kempsmith Machine Co., 1819 S. 71st St., Milwaukee 14, Wis.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Nichols-Morris Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Sundstrand Mch Tool Co., 2531 11th St., Rockford, Ill.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Turner Bros., Inc., 2625 Hilton Rd., Ferndale 20, Mich.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

INDICATORS, Dial

Ames, B. C., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P.O. Box 1027, Providence, R. I.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Scherr, George, Co., Inc. 200 Lafayette St., New York 12, N. Y.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, The L. S., Co., Athol, Mass.

INDICATORS, Speed

Brown & Sharpe Mfg. Co., Providence, R. I.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S., Co., Athol, Mass.

(*Continued on page* 358)

For more information on products advertised, use Inquiry Card, page 243

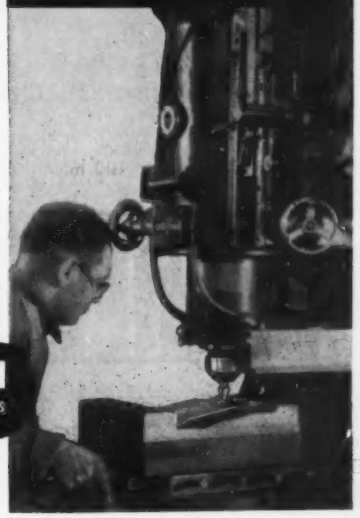


T-J toughness

means more work between grinds...

LOWER DIE COSTS!

This T-J Cutter at work on a connecting-rod die block for a board drop hammer. Material being milled is "Hardtem" die steel. A cutter of right design and heat treatment for this high speed work in tough die steels, making possible maximum efficiency of these machines.



LARGEST SELLING CUTTERS FOR TOUGH DIE STEEL

Be sure of *top performance* in die sinking milling cutters . . . specify T-J! They're preferred everywhere today in die and forge shops . . . because T-J Cutters are *extra sturdy* . . . you can raise the feed!

Designed for speed, accuracy and long life . . . hold a sharp edge longer on job after job . . . less breakage! Made from an extremely high grade steel . . . properly machined . . . scientifically heat-treated and accurately ground. Wide range of styles and sizes to *reduce your* die costs. Send for new catalog 4-153. The Tomkins-Johnson Co., Jackson, Mich.

FOR TOUGH JOBS SPECIFY

T-J TOMKINS-JOHNSON

RIVITORS . AIR AND HYDRAULIC CYLINDERS . CUTTERS . CLINCHORS

38 YEARS EXPERIENCE

For more information on products advertised, use Inquiry Card, page 243

INDICATORS, Test

Ames, B. C., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Instrument Co., 735 Carnegie Ave., Cleveland 15, Ohio.
Federal Products Corp., P.O. Box 1027, Providence, R. I.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Standard Gage Co. Inc., Poughkeepsie, N. Y.
Starrett, The L. S., Co., Athol, Mass.

INDUCTION HEATING EQUIPMENT

General Electric Co., Schenectady, N. Y.
Ohio Crankshaft Co., 3800 Harvard Ave., Cleveland, Ohio.

INTENSIFIERS, Hydraulic

Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Farquhar, A. B., Div. Oliver Corp., 142 North Duke St., York, Pa.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Morgan Engrg. Co., Alliance, Ohio.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.

JACKS, Planer

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.

JIG BORER

See Boring Machines, Jig.

JIGS AND FIXTURES

Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Columbus Die, Tool & Mch. Co., 955 Cleveland Ave., Columbus, Ohio.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Ingersoll Milling Machine Co., 2442 Douglas St., Rockford, Ill.
Jahn B., Manufacturing Co., Ellis St., New Britain, Conn.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
National Broach & Machine Co., 5600 St. Jean St., Detroit 13, Mich.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

JOINTS

See Fittings, Hydraulic, Pneumatic, Etc.

KEYSEATERS

Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Consolidated Mch. Tool Co., Rochester, N. Y.
Davis Keyseater Co., 405 Exchange St., Rochester 8, N. Y.
Lapointe Machine Tool Co., 34 Tower St., Hudson, Mass.
Mitts & Merrill, 68 Holden St., Saginaw, Mich.

KNURL HOLDERS

Brown & Sharpe Mfg. Co., Providence, R. I.
Pratt & Whitney, West Hartford 1, Conn.

KNURLING TOOLS

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Pratt & Whitney, West Hartford 1, Conn.
Reed Rolled Thread Die Co., P.O. Box 350, Worcester 1, Mass.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

LAPPING MACHINES

Barnes Drill Co. (Straight Line or Rotating), 814 Chestnut St., Rockford, Ill.
Cincinnati Grinders, Inc. (Centerless), Cincinnati, Ohio.
Crane Packing Co., 1800 Cuyler Ave., Chicago, Ill. (Lapmaster Div.)
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Micromatic Hone Corp., 8100 Schoolcraft, Detroit 4, Mich.
Norton Co., 1 New Bond St., Worcester 6 Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

LAPPING PLATES, Hand

Crane Packing Co., 1800 Cuyler Ave., Chicago.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.

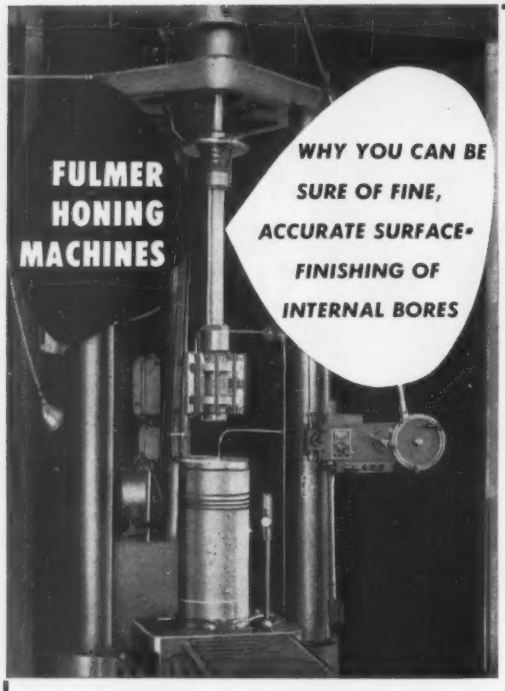
LATHE AND GRINDING DOGS

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Williams, J. H., & Co., 400 Vulcan St., Buffalo 7, N. Y.

LATHE ATTACHMENTS

American Tool Works Co., Pearl and Eggleston Aves., Cincinnati, Ohio.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Oakley, Cincinnati 9, Ohio.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Jones & Lamson Mch., 160 Clinton St., Springfield, Vt.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.

(Continued on page 360)



Photographed in plant of THE HUNT-SPILLER MFG. CORP. BOSTON, MASS.

METAL IS SHEARED OFF by abrasive stones which produce chips from dust to curly chips up to 6 inches long.

ACCURACY is guaranteed because all surface irregularities are eliminated to tolerances as close as .0001 (±).

REMOVE AS MUCH AS 1/16 INCH AT 1½ TO 2 CU. INCH PER MINUTE for ferrous and non-ferrous metals, glass, plastic, etc.

SURFACE FINISH OF AMAZING SMOOTHNESS results from the self-sharpening abrasive which will not smear or distort the surface and produces a uniform finish on all parts of the bore. Identical finishes may be duplicated by the same honing set-up. Any degree of roughness may be attained from 1 to 100 micro-inches rms.

C. ALLEN FULMER CO.

1231 First National Bank Bldg. Cincinnati 2, Ohio

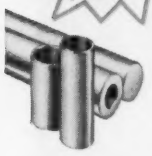
WRITE for our bulletin on honing.

For more information on products advertised, use Inquiry Card, page 243

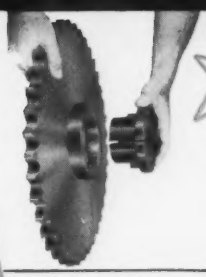
Here's your guide to NEW SAVINGS with NEW Standardized BOSTON Gear Products — from STOCK

NEW

Certified
BEAR-N-BRONZ Solid Bronze Bearings



A complete line — 768 stock sizes of Standard Bearings — 221 stock sizes of Cored Bars — 35 stock sizes of Solid Bars. CERTIFIED Highest Quality, with a MONEY-BACK offer.



NEW

SPROCKETS Larger, heavy duty SHOLD-A-GRIP Interchangeable Tapered Sprockets and Bushings

Sprockets up to 24" pitch dia. — and Bushings to fit shaft sizes from ½" to 3" by 16ths. Also, more sizes available in conventional sprockets.

NEW

BOST-BRONZ BEARING BANK



A sturdy metal kit, with 47 common sizes of Bost-Bronz oil-impregnated bearings, from which 313 standard sizes can be cut with a hacksaw — means you have any bearing you need on *hand* in any emergency. Saves 50% over buying same bearings separately.

20 SHAFT SIZES UP TO 2 1/16"



NEW

PILLOW BLOCKS and Flanged Cartridges in larger sizes

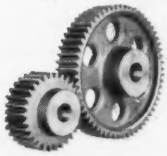
ADDED TO FORMER ½" TO 1¼" RANGE



Now, precision Type ABEC No. 1 Classification Bearings in a stock size range for 27 shaft sizes from ½" to 2 1/16", fully self-aligning.

NEW

20° PRESSURE ANGLE SPUR GEARS in a full range of stock sizes



Off-the-shelf delivery on 20 pitch to 4 pitch with pitch diameters from .6" to 40". Save 20% in weight — space — cost.

NEW PRODUCTS Catalog NP-55

lists full specifications of these new Boston Gear products and many others in 196 pages. Get your copy . . . use it with your BOSTON Gear General Catalog No. 55 . . . for up-to-the-minute information on the products that make BOSTON Gear first choice of cost-wise buyers.

NEW

3-PIECE JAW COUPLING with BOST-BRONZ insert



BOST-BRONZ oil-impregnated Bearing cushions torsional load, resists wear from any rubbing friction . . . 17 stock sizes, with hole diameters from 3/8" to 1½".



Get your copy from your nearby

BOSTON Gear®

DISTRIBUTOR

Look under "Gears" in the Yellow Classified Section of your Telephone Directory for the BOSTON Gear Distributor nearest you. Catalog NP-55 also available from Boston Gear Works, 65 Hayward St., Quincy 71, Mass.

For more information on products advertised, use Inquiry Card, page 243

Better than ever . . .

L&J PRESSES
Better-Built for Better Work



L&J Presses are producing work of better quality in larger volumes at reduced costs for numerous manufacturers. Here's why they do it:

- **Heavier, more rigid frames give minimum deflection for greater accuracy, longer die life at higher press speeds.**
- **Replaceable bronze bushings are standard equipment on two main and upper ram bearings.**
- **Roller bearings are standard in flywheel or main gear and backshaft mountings.**
- **Precision-scraped gibs of extra length for more permanent alignment and accuracy.**
- **Balanced designing plus precision manufacture for better performance and dependability.**

These are but a few of the reasons why L&J Presses can improve your press work and affect economies. 17 O.B.I. models—6 to 80 ton capacities—all available with air clutches. *Write for literature.*

L&J PRESS CORPORATION
1631 STERLING AVENUE
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Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio.
Pratt & Whitney, West Hartford 1, Conn.
Reed Rolled Thread Die Co., P.O. Box 350, Worcester 1, Mass.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sidney Machine Tool Co., Sidney, Ohio.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Springfield Mch. Tool Co., Springfield, Ohio.
Sunstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

LATHE CONVERTER

Master Mfg Co., Hutchinson, Kansas.

LATHES, Automatic

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Cone Automatic Mch. Co., Inc., Windsor, Vt.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Goss & DeLeeuw Mch. Co., Kensington, Conn.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Porter-Cable Machine Co., Salina St., Syracuse, N. Y.
Potter & Johnston Co., 1027 Newport Ave., Pawtucket, R. I.
Pratt & Whitney, West Hartford 1, Conn.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

LATHES, Axle

Consolidated Mch. Tool Corp., Rochester, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

LATHES, Bench

Casa Corp., 405 Lexington Ave., New York 17, N. Y.
Hardinge Bros., Inc., 1418 College Ave., Elmira, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Pratt & Whitney, West Hartford 1, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

LATHES, Boring

Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
Sidney Machine Tool Co., Sidney, Ohio.

LATHES, Crankshaft

Consolidated Mch. Tool Corp., Rochester, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

LATHES, Double-End

Consolidated Mch. Tool Corp., Rochester, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Lehmann Machine Co., 3560 Chouteau Ave., St. Louis, Mo.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

LATHES, Duplicating

H.E.B. Machine Tools, Inc., 475 Fifth Ave., New York 17, N. Y.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Lehmann Machine Co., 3560 Chouteau Ave., St. Louis, Mo.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio.
Sidney Machine Tool Co., Sidney, Ohio.

LATHES, Engine and Toolroom

American Tool Works Co., Pearl and Eggleston Aves., Cincinnati, Ohio.
Axelson Mfg. Co., P.O. Box 15335, Vernon Sta., Los Angeles 58, Calif.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Oakley, Cincinnati 9, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
H.E.B. Machine Tools, Inc., 475 Fifth Ave., New York 17, N. Y.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Lehmann Machine Co., 3560 Chouteau Ave., St. Louis, Mo.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
Logan Engrg. Co., 4901 W. Lawrence Ave., Chicago 30, Ill.
Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio.
Morey Machinery Co., Inc., 383 Lafayette St., New York, N. Y.
Nebel Machine Tool Co., 3401 Central Parkway, Cincinnati 25, Ohio.
Pratt & Whitney, West Hartford 1, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.
Sidney Machine Tool Co., Sidney, Ohio.
Simmons Machine Tool Corp., 1600 N. Broadway, Albany, N. Y.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Springfield Mch. Tool Co., Springfield, Ohio.

LATHES, Gap

Axelson Mfg. Co., P.O. Box 15335, Vernon Sta., Los Angeles 58, Calif.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Oakley, Cincinnati 9, Ohio.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
H.E.B. Machine Tools, Inc., 475 Fifth Ave., New York 17, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
Nebel Machine Tool Co., 3401 Central Parkway, Cincinnati 25, Ohio.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sidney Machine Tool Co., Sidney, Ohio.
Springfield Mch. Tool Co., Springfield, Ohio.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

(*Continued on page 362*)

For more information on products advertised, use Inquiry Card, page 243



Let this unique illustration convey to you the remarkable cooling effect of Howell's new internal ventilation system in Series 100 Motors.

New Howell re-rated motors run cooler... last longer

Your motor needs have changed just as your machines have changed. Here are *completely new* motors . . . designed and built to meet *today's* requirements!

Now! Howell brings you everything you want in a re-rated motor: smaller size and lighter weight . . . plus *better cooling* for less maintenance and longer life.

Howell Series 100 re-rated motors feature a new internal ventilation system that provides 50% more contact between cooling air and active lamination materials. Temperature ratings are easily maintained; overload capacity is increased.

Many New Features

Series 100 Motors offer many other advantages: *They take up less space* — up to 30% less in some sizes; both open and totally enclosed fan-cooled motors have same diameters. *They perform better* — Howell uses dependable copper rotors for higher conductivity, greater flexibility; new Mylar* slot insulation is thinner (more space for copper windings), yet eight times stronger. *They last longer* — better cooling, double-shielded bearings and super tough steel frames and feet, with cast iron endplates, insure extra years of trouble-free performance. *They fit your special needs* — Howell provides rotors in three diameters for each frame size; corrosion-resistant materials and fittings are available to meet your specific industry problems.

Before you buy any re-rated motor, compare Howell Series 100 Motors for modern design, outstanding performance, and engineered precision. Howell will continue to make a complete line of regular and special motors — we have in our files more than 20,000 electrical design specifications! Let us serve you. Call your Howell man today.

*DuPont trade mark

HOWELL Red Band MOTORS

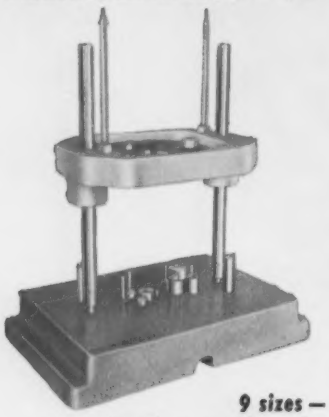
HOWELL MOTORS

Howell Electric Motors Company, Howell, Michigan

MOTORS FOR INDUSTRY SINCE 1915

Zagar Self-clamping DRILL JIGS

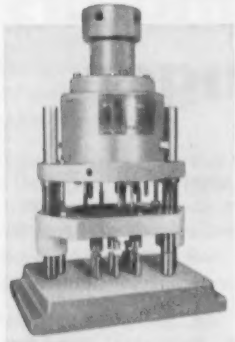
NOW STANDARDIZED for DRILLING, REAMING, TAPPING



9 sizes — 5 combinations per size — for hole patterns 3" through 15" dia.

Standardization makes for quick delivery and attractive price. Only a few minor parts need be made. Speed up machining operations. The operator merely feeds the parts — the Zagar Self-clamping Drill Jig does the rest. Zagar drill jigs are now "off the shelf".

♦ ♦ ♦



Zagar drill jigs can be used in conjunction with Zagar gearless multiple-spindle drill heads to ream, drill, and tap on standard drill presses and tapping machines. Or, Zagar can quickly supply the complete "package" unit.

♦ ♦ ♦

Write for new Bulletin "M9."

ZAGAR TOOL, INC.

24000 LAKELAND BLVD., CLEVELAND 23, O.

Zagar TOOLS For INDUSTRY and SPECIAL MACHINERY

LATHES, Gun

Consolidated Mch. Tool Corp., Rochester, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Lehmann Machine Co., 3560 Chouteau Ave., St. Louis, Mo.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Springfield Machine Tool Co., Springfield, Ohio.

LATHES, Hollow Spindle

Axelson Mfg. Co., P.O. Box 15335, Vernon Sta., Los Angeles 58, Calif.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Lehmann Machine Co., 3560 Chouteau Ave., St. Louis, Mo.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

LATHES, Manufacturing Type

Lipe-Rollway Corp., 806 Emerson Ave., Syracuse, N. Y.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.

LATHES, Spinning

Bliss, E. W., Co., 1375 Raff Rd., S. W., Canton, Ohio.
Ferracute Machine Co., Bridgeton, N. J.

LATHES, Toolroom

See Lathes, Engine and Toolroom.

LATHES, Turret

Bardons & Oliver Inc., Ft. W. 9th St., Cleveland 13, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Hardinge Brothers, Inc., (Bench or Cabinet Mounting), 1418 College Ave., Elmira, N. Y.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Morey Machinery Co., Inc., 383 Lafayette St., New York, N. Y.
Potter & Johnson Co. (Automatic), 1027 Newport Ave., Pawtucket, R. I.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Simmons Mch. Tool Corp., 1600 N. Broadway, Albany, N. Y.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Springfield Mch. Tool Co., Springfield, Ohio.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

LATHES, Vertical Turret

American Steel Foundries, King Mch. Tool Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Bullard Co., Brewster St., Bridgeport 2, Conn.

LAYOUT FLUID

Dykem Co., 2303 P. North 11th St., St. Louis 6, Mo.

LEVELS

Bullard Co., Brewster St., Bridgeport 2, Conn.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Millers Falls Co., Greenfield, Mass.
Pratt & Whitney, West Hartford 1, Conn.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

LOCKNUTS

Link-Belt Co. (For Positioning Bearings), 519 N. Holmes Ave., Indianapolis 6, Ind.

LUBRICANTS, Including Extreme pressure (EP) Machinery Lubricants

Cities Service Oil Co., 70 Pine St., New York, N. Y.
Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Lubriplate Div., Fiske Bros. Refining Co., 120 Lockwood St., Newark 5, N. J.
Shear-Speed Chem. Prod. Div., Michigan Tool Co., 7125 E. McNichols Rd., Detroit 12, Mich.
Sinclair Refining Co., 600 5th Ave., New York, N. Y.
Standard Oil Co., (Indiana), 910 S. Michigan, Chicago, Ill.
Stuart, D. A., Oil Co., Ltd., 2739 S. Troy St., Chicago 23, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia, Pa.
Texas Co., 135 E. 42nd St., New York, N. Y.

LUBRICATING SYSTEMS

Farval Corp., 3249 E. 80th St., Cleveland, Ohio.
Madison-Kipp Corp., Madison, Wis.
Norgren, C. A., Co., Inc., 3419 S. Elati St., Englewood, Colo.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.

MACHINE KEYS

Gillen, John, Co., Inc., 2540 S. 50th Ave., Cicero 50, Ill.

MACHINE PARTS, Special

Gillen, John, Co., Inc., 2540 S. 50th Ave., Cicero 50, Ill.

MACHINISTS' SMALL TOOLS

See Calipers, Hammers, Wrenches, Drills, Taps, Etc.

MANDRELS

See Arbors and Mandrels.

MARKING MACHINES AND DEVICES

Colonial Broach Co., P.O. Box 37, Harper Sta., Detroit, Mich.

MEASURING MACHINES AND INSTRUMENTS, Precision

Cleveland Instrument Co., 735 Carnegie Ave., Cleveland 15, Ohio.
Crane Parking Co., 1800 Cuyler Ave., Chicago.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P.O. Box 1027, Providence, R. I.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Pratt & Whitney, West Hartford 1, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Van Keuren Co., 176 Waltham St., Watertown, Boston, Mass.

MEASURING WIRES, THREAD, SPLINE AND GEAR

Taft-Peirce Mfg. Co., Woonsocket, R. I.
Van Keuren Co., 176 Waltham St., Watertown, Boston, Mass.

METAL, Bearings

See Bearings, Bronze, Babbitt, Etc., and Bushings, Brass, Bronze, Etc.

METERS

See Recording instruments.

MICROMETERS

Ames, B. C., Co. (Dial), Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Millers Falls Co., Greenfield, Mass.
Pratt & Whitney, West Hartford 1, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

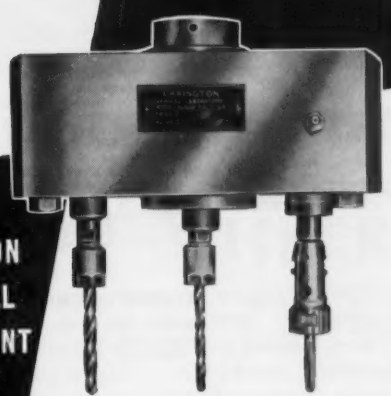
(Continued on page 364)

For more information on products advertised, use Inquiry Card, page 243

NOW YOU CAN

- DRILL
- COUNTERSINK
- REAM
- COUNTERBORE
- TAP

ERRINGTON TAP-DRILL ATTACHMENT



Capacity to ¼" drill and 5/16" tap. Available with 2, 3 or 4 spindles. Spindles spaced to handle work up to 5½" outside diameter.

ALL ON ONE DRILL PRESS SPINDLE

... without taking your hand off drill press feed handle. Yes ... with this new Errington Tap-Drill attachment, you simply slide the work under the head from one spindle to another. An automatic reversing tapping spindle is built in, making it unnecessary to reverse the drill press for tapping.

Hardened and ground spindles. Gears turned on spindles (not pinned on). Heavy duty grooved ball thrust bearings all enclosed in a sand cast aluminum case and cover.

Send For Complete Information

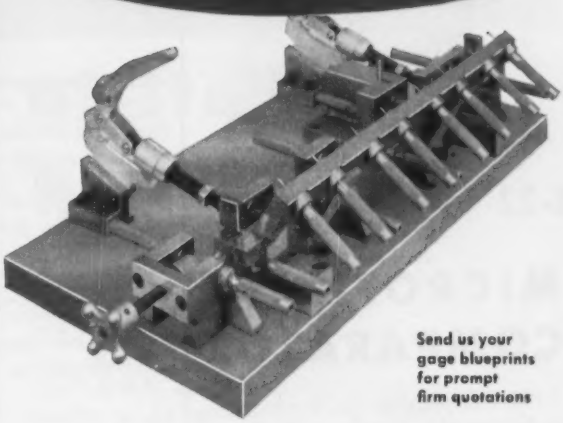
ERRINGTON Mechanical Laboratory, Inc.
Established 1891
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TODAY'S PRODUCTION PROBLEMS demand

Precision Gages

another

TOUGH ONE whipped by AMCO



Send us your gage blueprints for prompt firm quotations

THIS Location Gage

built to the most

EXACTING STANDARDS

for one of the NATION'S LEADING AUTOMOBILE ENGINE MANUFACTURERS, ACCURATELY CHECKS GEAR CENTERS in relation to DOWEL HOLES.

PRECISE MULTIPLE ACTION
with corresponding multiple time saving,

CUTS PRODUCTION COSTS



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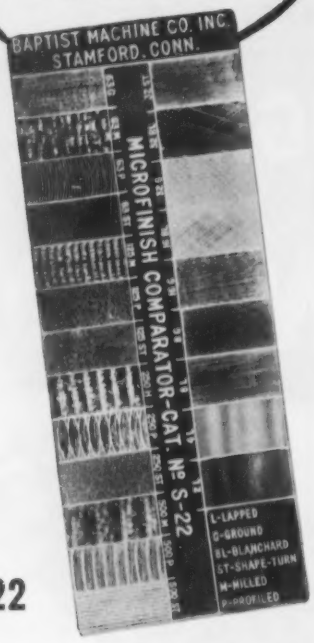
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MICRO-INCH PRECISION GAGES SINCE 1941

19760 W. EIGHT MILE ROAD • DETROIT 19, MICH.

NOW!

DETERMINE SURFACE FINISH QUICKLY, ACCURATELY



S-22

MICROFINISH COMPARATOR

Men responsible for finish, specify control roughness with Electroformed pocket Comparators—the only inexpensive, uniform system of comparison.

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Pratt & Whitney, West Hartford 1, Conn.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

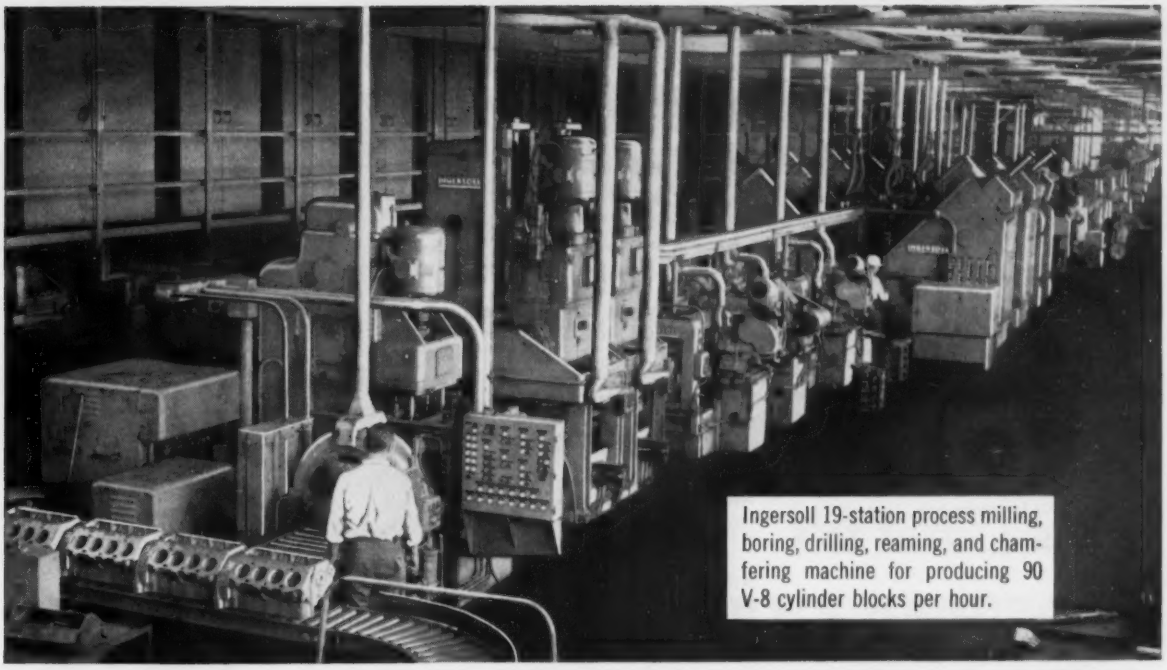
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(*Continued on page* 366)



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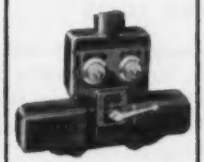
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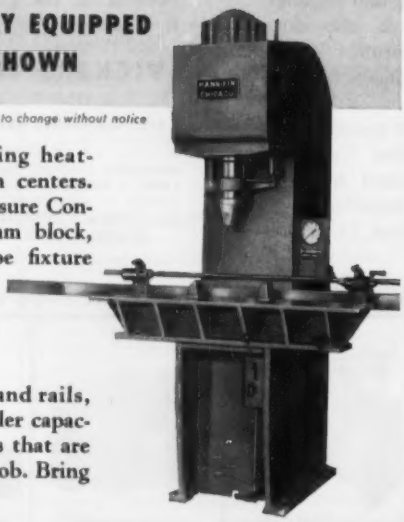
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(*Continued on page* 368)

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(*Continued on page 370*)



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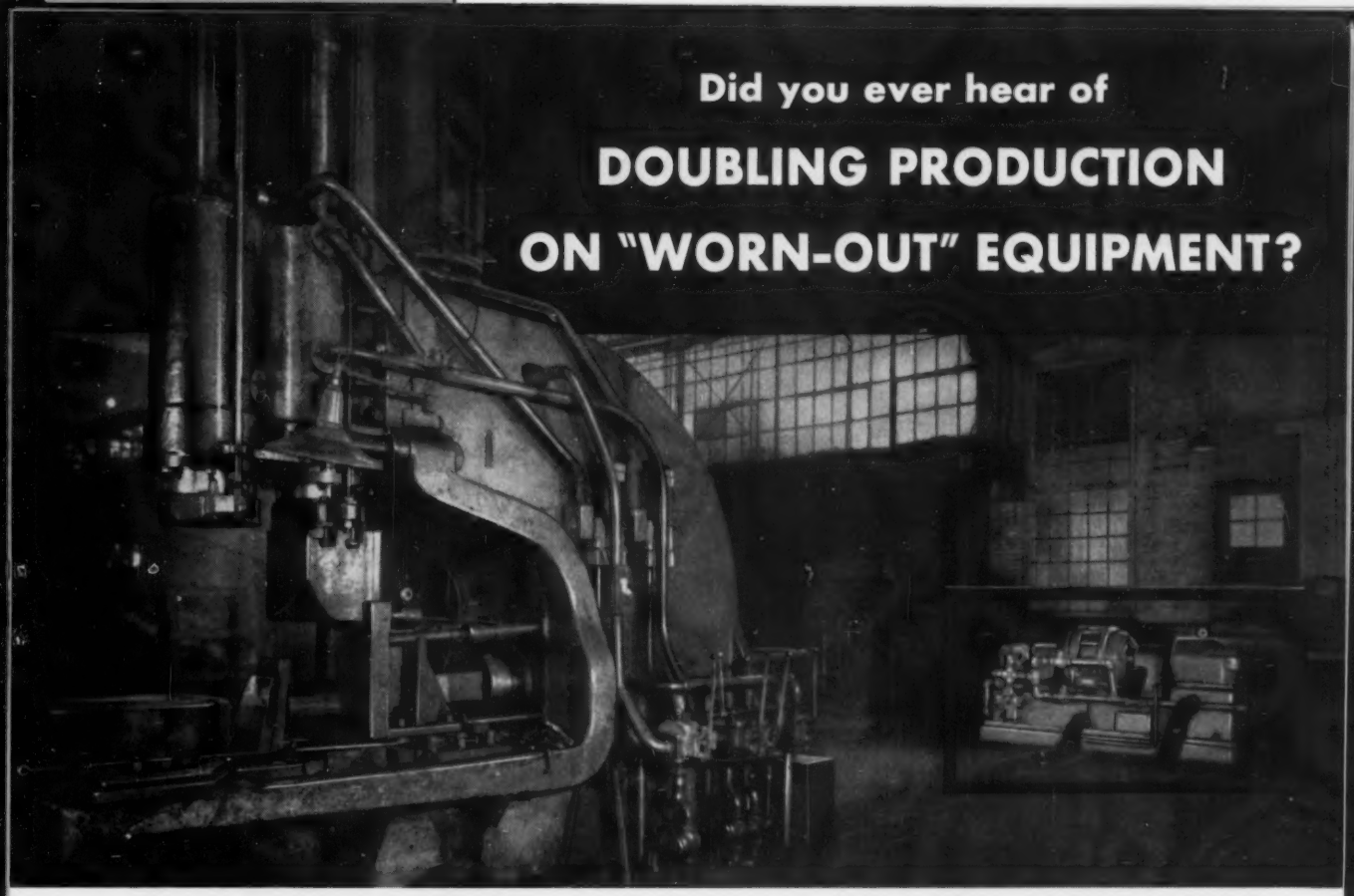
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The belling machine used for flanging big boiler ends in the Treadwell Corporation plant at Midland, Pa., has seen many years of service. The machine was slow, was "down" a lot, maintenance was high and production was off.

A careful analysis indicated that the press itself was not at fault; the trouble was associated entirely with the water pump, storage and accumulator system used to power the press gripping and main rams.

Two alternatives confronted the Treadwell people. One was to repair or replace the water system. This ran into a figure prohibitively high. It would not solve the problem of high maintenance, faulty control, erratic performance, the shocks inherent in the system, the slow cycles.

The Treadwell people chose the second alternative and called in an Oilgear Fluid Power engineering representative. This is what happened:

A standard Oilgear Fluid Power system was installed, without modification to the press. The only change was some rearrangement of the piping system. The cost was from one-fourth to one-third that of repair to or replacement of the water power system.

The operation of the rams was speeded up, the total time for each cycle cut from 66 seconds to 34 seconds. Therefore actual press production was almost doubled. Because the power medium used is oil, friction and wear become almost non-existent. The space required is slightly less than that required by the water pump, but the bulky water tank and accumulator were eliminated altogether.

The interesting thing about this Oilgear Fluid Power, which is smooth, shockfree and dependable is that from the one source, power travels to actuate the gripping rams, then while holding them at gripping pressure, travels over to the main or shaping ram and actuates it; then the same power retracts the rams in order and goes into "neutral" during the next handling step.

The above is only one of a number of similar press "renovations" being performed with the use of Oilgear Fluid Power.

Think of Oilgear Fluid Power as similar in every respect to electric power. It is generated, piped, and applied in the same way, with these **important** exceptions: Oilgear Fluid Power can be used in linear movement where electricity cannot. Oilgear Fluid Power speed can be varied steplessly, smoothly, infinitely where electricity cannot — or only with costly, troublesome, **extra** equipment. Oilgear Fluid Power can be "bled" off, dissipated harmlessly in case of shock. Oilgear is massive, tremendous, resistless power that can be controlled with micrometer precision.

It is probably the most amazingly versatile power there is. Consider Oilgear Fluid Power to improve the saleability of new machines, to renovate old machines, to solve a hundred troublesome problems where other power has failed to help. It costs you nothing to find out.

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Hannifin Corp., 1101 S. Kilbourn Ave., Chicago.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Tomkins-Johnson Co., 614 No. Mechanic St., Jackson, Mich.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.
Wilson, K. R., 213 Mill St., Arcade, N. Y.

PRESSES, Broaching

American Broach & Mch. Co., Ann Arbor, Mich.
Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Colonial Broach Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.
Dake Engine Co., 604 Seventh St., Grand Haven, Mich.
Farquhar, A. B., Div. Oliver Corp., 142 North Duke St., York, Pa.
Ferracute Machine Co., Bridgeton, N. J.
Lake Erie Engrg. Co., Kenmore Station, Buffalo, N. Y.
Lapointe Machine Tool Co., 34 Tower St., Hudson, Mass.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4, Wis.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.

PRESSES, Extrusion

American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati.
Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Chambersburg Engrg. Co., Chambersburg, Pa.
Farquhar, A. B., Div. Oliver Corp., 142 North Duke St., York, Pa.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Lake Erie Engrg. Co., Kenmore Station, Buffalo, N. Y.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.

PRESSES, Foot

Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Famco Machine Co., 3134 Sheridan Rd., Kenosha, Wis.
Ferracute Machine Co., Bridgeton, N. J.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.

PRESSES, Forging

Ajax Mfg. Co., Euclid, Cleveland 17, Ohio.
American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E. Cleveland, Ohio.
Dake Engine Co., 604 Seventh St., Grand Haven, Mich.
Erie Foundry Co., Erie, Pa.
Farquhar, A. B., Div. Oliver Corp., 142 North Duke St., York, Pa.
Ferracute Machine Co., Bridgeton, N. J.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
Morgan Engrg. Co., Alliance, Ohio.
National Mchry. Co., Greenfield and Stanton Sts., Tiffin, Ohio.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Verson Allsteel Press Co., 93rd St. and S. Kenwood Ave., Chicago, Ill.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.
Wilson, K. R., 213 Mill St., Arcade, N. Y.

PRESSES, Hydraulic

American Broach & Mch. Co., Ann Arbor, Mich.
American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Anderson Bros. Mfg. Co., 1910 Kishwaukee St., Rockford, Ill.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Birdsboro Steel Fdry. & Mch. Co., Birdsboro, Pa.
Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Chambersburg Engrg. Co., Chambersburg, Pa.
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Colonial Broach Co., P. O. Box 37, Harper Sta., Detroit, Mich.
Dake Engine Co., 604 Seventh St., Grand Haven, Mich.
Denison Engrg. Co., 1160 Dublin St., Columbus 16, Ohio.
Erie Foundry Co., Erie, Pa.
Farquhar, A. B., Div. Oliver Corp., 142 North Duke St., York, Pa.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
Lapointe Machine Tool Co., 34 Tower St., Hudson, Mass.
Morgan Engrg. Co., Alliance, Ohio.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4, Wis.
Turner Bros., Inc., 2625 Hilton Rd., Ferndale 20, Mich.
Verson Allsteel Press Co., 93rd St. and S. Kenwood Ave., Chicago, Ill.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.
Wilson, K. R., 213 Mill St., Arcade, N. Y.

PRESSES, Screw

Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Dake Engine Co., 604 Seventh St., Grand Haven, Mich.
Ferracute Machine Co., Bridgeton, N. J.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.

PRESSES, Sheet Metal Working

Allen, Alva F., Box 426, Clinton, Mo. (Bench)
American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Chambersburg Engrg. Co., Chambersburg, Pa.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Cleveland Crane & Engrg. Co., Wickliffe, Ohio.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Dake Engine Co., 604 Seventh St., Grand Haven, Mich.
Danly Machine Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Dreis & Krump Mfg. Co., 7416 Loomis Blvd., Chicago 36, Ill.
Espen-Lucas Machine Works, Front St., and Girard Ave., Philadelphia, Pa.
Famco Machine Co., 3134 Sheridan Rd., Kenosha, Wis.
Farquhar, A. B., Div., Oliver Corp., 142 North Duke St., York, Pa.
Ferracute Machine Co., Bridgeton, N. J.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
L & J Press Corp., Elkhart, Ind.
Minster Machine Co., Minster, Ohio.

(*Continued on page* 374)

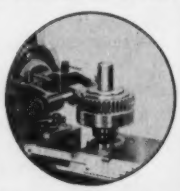
PARKSON GEAR TESTERS

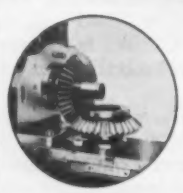
The Rolling Test is Practical Common Sense

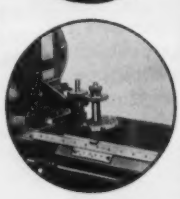
- **Indicates RUN-OUT, CENTER DISTANCE by 1/1000 vernier, BACKLASH, TOOTH JUMP, etc.**
- **It catches the error directly in the shop where the gears are cut.**



The MODEL B shown takes in SPUR WORM SPIRAL and BEVEL GEARS from 1/4" to 9" Center Distance

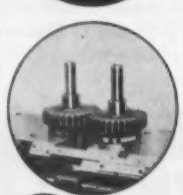


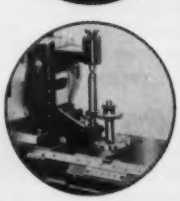




STUDY THESE PICTURES and reflect how ingeniously and simple every gear problem has been solved, including pinions with shaft, small gear 1/2" center distance, worm gears, spiral gears and even bevel gears. All without extra attachments.

NOTE that in the PARKSON the tests are being made on fixed arbors or studs avoiding rotating shafts or bearings liable to introduce errors not in the gears themselves.





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GEO. SCHERR CO., INC.

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COMPLETE LINE OF PRECISION INSTRUMENTS

For more information on products advertised, use Inquiry Card, page 243

LOW COST DESIGN CHANGE BOOSTS MACHINERY SALES

A Switch to *Sier-Bath* Precision Gears Gave Machine Tool Ability to Take Heavier Cuts at Higher Speeds

Many other important advantages gained

CASE: A machine tool manufacturer asked us to go over the gearing in one of his models with an eye to improvements. We reported that with certain gear tolerances and gear design changes he could:

enable his product to take much heavier cuts at higher speeds

gain positive, trouble-free operation

sharply reduce noise and vibration

practically eliminate the possibility of breakdowns

He went ahead with Sier-Bath Gears, and made the improvements. The result: *a tremendous increase in sales.*

To check the possibilities better gearing offers you on existing designs . . . re-designs . . . new designs . . . phone, write or wire for free consultation. We'll specify gear tolerances . . . provide the newest, most advanced gear designs. *Sier-Bath Gear & Pump Co., Inc., Dept. E, 9248 Hudson Blvd., North Bergen, N. J.*

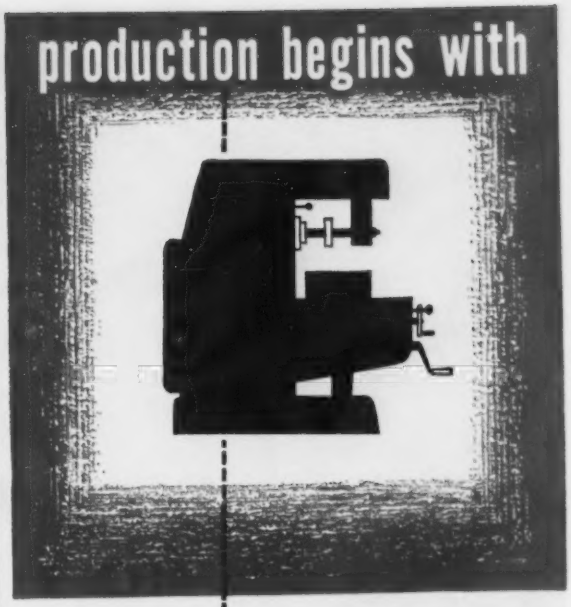
Sier-Bath PRECISION GEARS

Proven accuracy where required!

Send for folder: "Gear Errors Are Costly!"

Founded 1905 Member A.G.M.A.

Also Manufacturers of Rotary Pumps and Flexible Gear Couplings



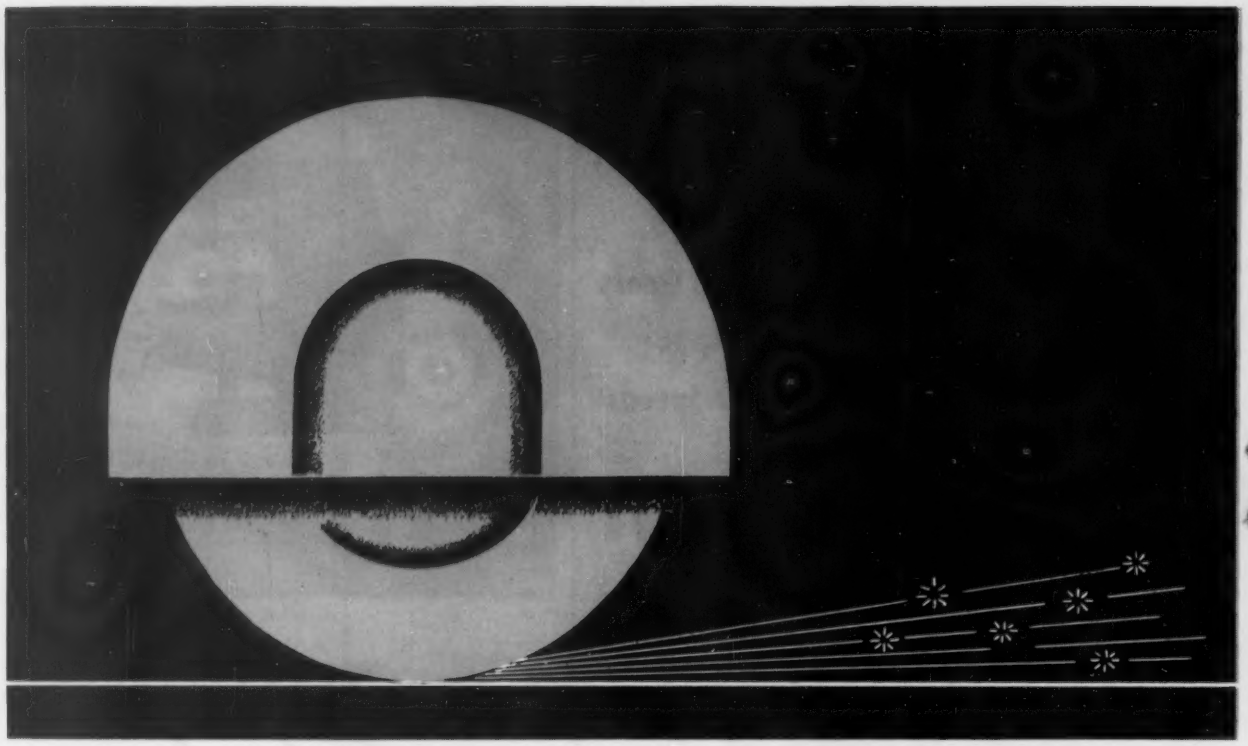
Columbus Die-Tool

No tools like the right tools! Columbus Die-Tool designs and builds tools, jigs, fixtures and special machinery to meet your most exacting requirements. RESULTS: operating cost that matches your budget; production that matches your schedule; product quality that matches the demands of your market.

Contact Columbus Die-Tool & Machine Co. first—when you have a special machine problem. They are nationally known as expert designers and builders of special machinery and equipment . . . have been for over 46 years.

Columbus Die-Tool
AND MACHINE COMPANY
P. O. BOX 750 • COLUMBUS, OHIO
ESTABLISHED 1906

Manufacturers of
JIGS • FIXTURES • BUILDING MACHINE TOOLS COMPLETE
SPECIAL TOOLS • UNITS FOR MACHINE TOOLS



Need Speed?... Accuracy?... Finish?...

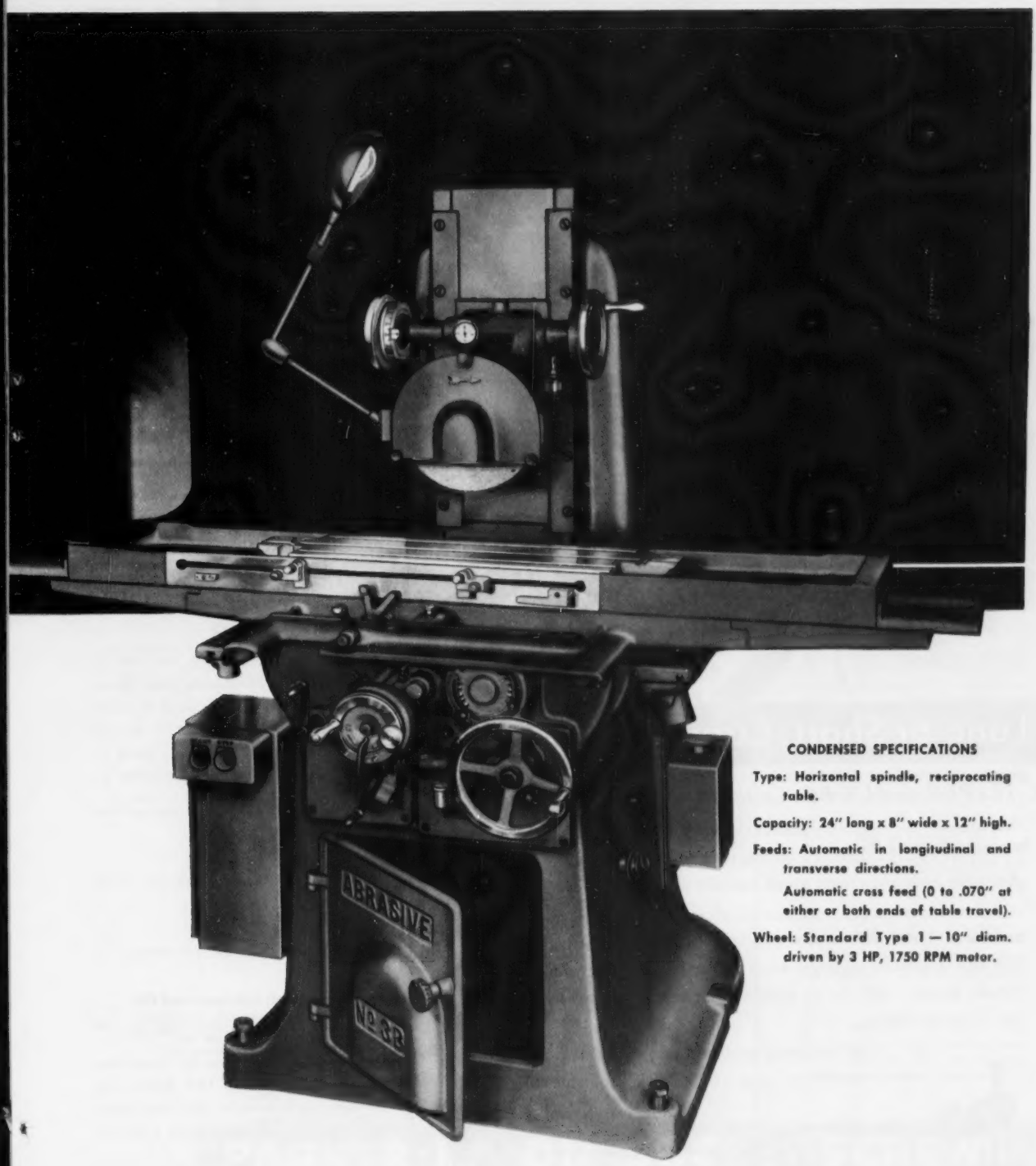
Get them all with the ABRASIVE No. 3B POWER FEED SURFACE GRINDER — one of the most productive and precise tools on the market today.

Feature for feature, the Abrasive No. 3B is unexcelled. It's massively built for maximum stability. Both toolmakers and production men know they can trust the No. 3B to hold size and finish within narrow limits. Automatic power feeds are easy to adjust and are located for greatest possible convenience. The large, open work table is designed for quick set-up and fast production. The No. 3B's unitized construction (bed, table, wheelhead, saddle, cross-feed mechanism, and gear case) provides easy accessibility. Quick adjustments or repairs can be made without calling in a specialist.

Thousands of Abrasive No. 3B Surface Grinders are in use in automotive, airplane engine, and tool plants throughout this country and abroad. If you are looking for the best in power feed surface grinders, it will pay you to find out about the Abrasive No. 3B. Write for descriptive catalog. Abrasive Machine Tool Company, 12 Dunellen Road, East Providence 14, Rhode Island.

ABRASIVE
ACCURACY BOOSTS PRODUCTION

ABRASIVE QUALITY IS RE



CONDENSED SPECIFICATIONS

Type: Horizontal spindle, reciprocating table.

Capacity: 24" long x 8" wide x 12" high.

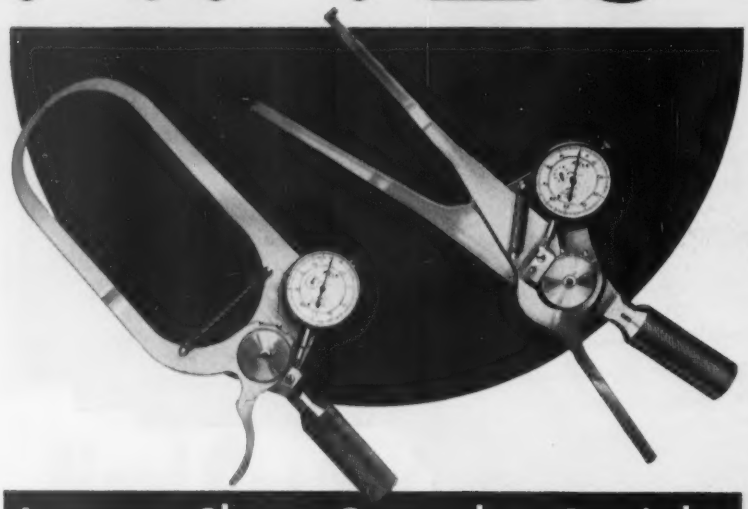
Feeds: Automatic in longitudinal and transverse directions.

Automatic cross feed (0 to .070" at either or both ends of table travel).

Wheel: Standard Type 1 — 10" diam. driven by 3 HP, 1750 RPM motor.

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AMES



Long or Short: Curved or Straight

CALIPER GAUGES· Custom-built to fit your exact need

Whatever your measuring problem – whether it's the inside dimensions of a pipe, the wall thickness of a casting, the outside dimensions of a rocket – Ames can build the caliper gauge that fills your requirements.

Ames caliper gauges are made of carefully-finished heavy gauge steel and are equipped with an Ames exclusive: a chordal error correcting cam that assures accurate readings. Ames calipers are available with contacts of various shapes – ball, flat or pointed – made of carbide, hardened steel, or sapphire.

Your measuring problems may involve a caliper gauge. If so, send it to Ames – for a quick, profitable solution.



Ames Dial Depth Gauge No. 11B



Write for your free copy of catalog on Ames precision measuring instruments.





Ames No. 13 Dial Comparator

Ames Trutest No. 1

Representatives in principal cities. B.-C. AMES CO. *27 Ames Street Waltham 54, Mass.*

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Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Sales Service Mch. Tool Co., 2363 University Ave., St. Paul, Minn.
Verson Allsteel Press Co., 93rd St. and S. Kenwood Ave., Chicago, Ill.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.
Wilson, K. R., 213 Mill St., Arcade, N. Y.

PRESSES, Straightening

American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Anderson Bros., Mfg. Co., 1910 Kishwaukee St., Rockford, Ill.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Chambersburg Engrg. Co., Chambersburg, Pa.
Colonial Broach Co., P. O. Box 37, Harper Sta., Detroit, Mich.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Dake Engine Co., 604 Seventh St., Grand Haven, Mich.
Farquhar, A. B., Div., Oliver Corp., 142 North Duke St., York, Pa.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Morgan Engrg. Co., Alliance, Ohio.
Niagara Machine & Tool Works (Hydraulic), 683 Northland Ave., Buffalo, N. Y.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4, Wis.
Springfield Mch. Tool Co., Springfield, Ohio.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.
Wilson, K. R., 213 Mill St., Arcade, N. Y.

PROFILE—TRACING ATTACHMENTS

Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa. (Lathe).

PROFILING MACHINES

Consolidated Mch. Tool Corp., Rochester, N. Y.
Cosa Corp, 405 Lexington Ave., New York 17, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Gorton, George, Machine Co., 1110 W. 13th St., Racine, Wis.
Morey Machinery Co., Inc., 383 Lafayette St., New York, N. Y.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield, Dayton, Ohio.

PULLEYS

Boston Gear Works, 3200 Main St., North Quincy 71, Mass.

PULLEYS, Friction Clutch

Brown & Sharpe Mfg. Co., Providence, R. I.

PUMPS, Coolant, Lubricant and Oil

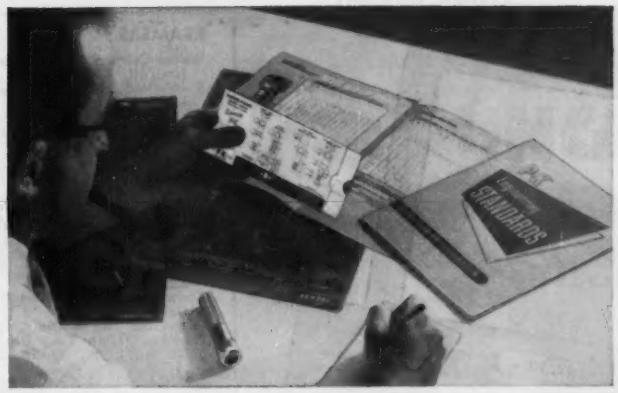
Brown & Sharpe Mfg. Co., Providence, R. I.
Delta Power Tool Div., Rockwell Mfg. Co., 620 E. Vienna Ave., Milwaukee, Wis.
Ingersoll-Rand Co., Phillipsburg, N. J.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Ruthman Machinery Co., 1809 Reading Rd., Cincinnati 12, Ohio.
Sier-Bath Gear & Pump Co., Inc., 9248 Hudson Blvd., North Bergen, N. J.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Tompkins-Johnson Co., Jackson, Mich.
Vickers Inc., 1402 Oakman Blvd., Detroit, Mich.
Viking Pump Co., Cedar Falls, Iowa.

PUMPS, Hydraulic

American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Barnes, John S., Corp., Rockford, Ill.
Bethlehem Steel Co., Bethlehem, Pa.
Brown & Sharpe Mfg. Co., Providence, R. I.
Chambersburg Engrg. Co., Chambersburg, Pa.
Denison Engrg. Co., 1160 Dublin St., Columbus 16, Ohio.

(*Continued on page 376*)

For more information on products advertised, use Inquiry Card, page 243



FOR PLANNING AIDS P-K Engineering Data meets every need of design, project, and methods engineers, gives anyone concerned with planning assemblies complete, clear, concise information. P-K Price Data speeds ordering routine, prevents errors. The P-K Socket Screw Dimension Finder shown in use is a pocket size plastic slide chart that gives all needed dimensions at a glance.

Look Beyond the Hex



The hex socket identifies all socket screws, but beyond the hex there's a big difference. If you have never tried P-K Socket Screws you are blocking you way to *proved* benefits other buyers are using to advantage.

Look *beyond* the hex. For example, until you see P-K product information, you'll have no idea how helpful it is . . . how much time it saves . . . how much easier it makes the job.

It pays to know the difference

Compare every detail of product and service. You'll find P-K Socket Screws take top rating by every test.

For cost-wise assembly, you need all these advantages. Why miss out on any of them? Try P-K Socket Screws. Get samples, information from your P-K Distributor or write: Parker-Kalon Division, General American Transportation Corporation, 202 Varick St., New York 14.

FOR ADVANCED DESIGN that speeds assemblies — makes them simpler, stronger — and saves errors.

FOR ASSEMBLY STRENGTH okayed in a million punishing tests by thousands of satisfied users.

FOR PLANNING AIDS and buying data patterned to your special needs, plus advice on assembly.

FOR SUPPLY SERVICE set up for fast action and lower purchasing expense — by local Distributors.

FOR ANY STYLE OR SIZE You'll find any Socket Screw you need in P-K's complete line. Hex Keys in all sizes, and several handy sets.

PARKER-KALON SOCKET SCREWS



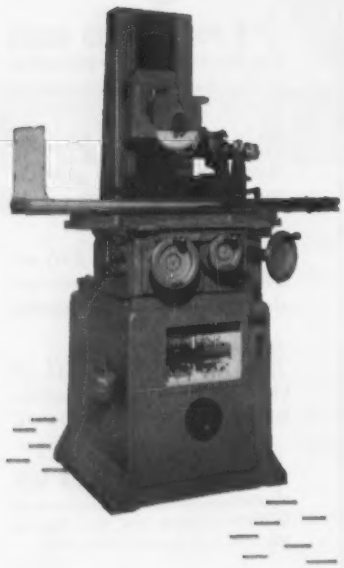
GET ALL THESE ESSENTIALS OF COST-WISE ASSEMBLY GET P-K

In Stock . . . for immediate delivery . . . see your nearby P-K Socket Screw Distributor



PLAN NOW FOR REPLACEMENT

with REID GRINDERS



It's strictly a dollars and sense proposition. The cost of a new surface grinder is not high in relation to the benefits that accrue from more accuracy, better quality finishes and ease of operation.

And it certainly makes sense, in today's competitive business world to replace older type grinders that invite work-spoilage and rejection.

If you're still using over-age surface grinders, it will be good "insurance" to talk with your Reid dealer today.

He'll show you why modern Reid Grinders will increase efficiency in your toolroom.

see our catalog in MACHINE TOOL CATALOGS or write for copy.

For the full story on Reid Surface Grinders, please write for Bulletin 618-2

Reid Brothers Company, Inc.

REAMERS

Barber-Colman Co., Rock and Montague, Rockford, Ill.
Butterfield Div., Union Twist Drill Co., Derby Line, Vt.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 27, Mich.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Greenfield Tap & Die Corp, Greenfield, Mass.
Haynes Stellite Co., Div. Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Keo Cutters, 19326 Woodward, Detroit, Mich.
Lipe-Rollway Corp., 806 Emerson Ave., Syracuse, N. Y.
McCosky Tool Corp., 1938 Thomas St., Meadville, Pa.
National Twist Drill & Tool Co., & Winter Bros. Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

REAMERS, Adjustable

Barber-Colman Co., Rock and Montague, Rockford, Ill.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Greenfield Tap & Die Corp., Greenfield, Mass.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Pratt & Whitney, West Hartford 1, Conn.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Union Twist Drill Co., Athol, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

REAMERS, Taper Pin

Butterfield Div., Union Twist Drill Co., Derby Line, Vt.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Greenfield Tap & Die Corp., Greenfield, Mass.
Kaufman Manufacturing Co., Manitowoc, Wis.
Lipe-Rollway Corp., 806 Emerson Ave., Syracuse, N. Y.
National Twist Drill & Tool Co., & Winter Bros. Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

REAMING MACHINES

Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Kaufman Manufacturing Co., Manitowoc, Wis.
Pratt & Whitney, West Hartford 1, Conn.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

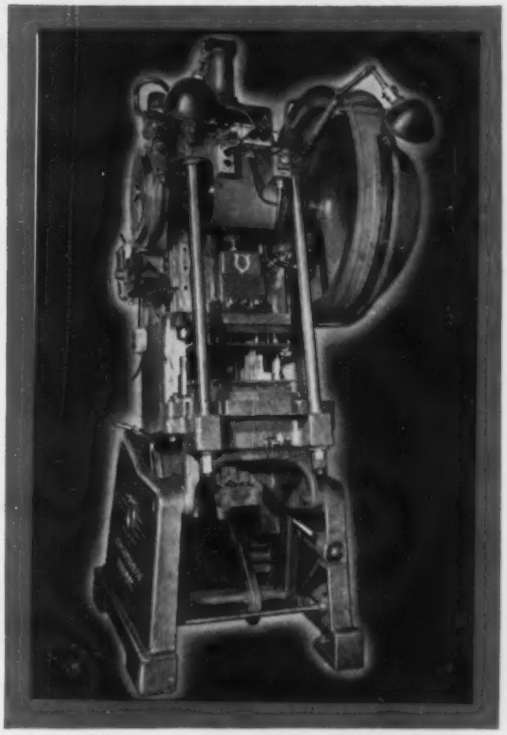
RECORDING INSTRUMENTS for Counting

National Acme Co., 170 E. 131st St., Cleveland, Ohio.

(*Continued on page* 378)

WHAT R-B PUNCHES SAVE...





What does this press cost you per hour?

If you use shoulder or set-screw type punches, you have excessive press down-time when replacing worn or broken punches.

But, with R-B interchangeable and standardized punches and die buttons you get quick insertion and removal in the press. The R-B ball lock features, that assure positive radial alignment and vertical locking without further keying, permit greater press utilization.

Use R-B Engineering Service for Your Tough Piercing Problems.

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Please send me additional information.



NAME_____ TITLE_____

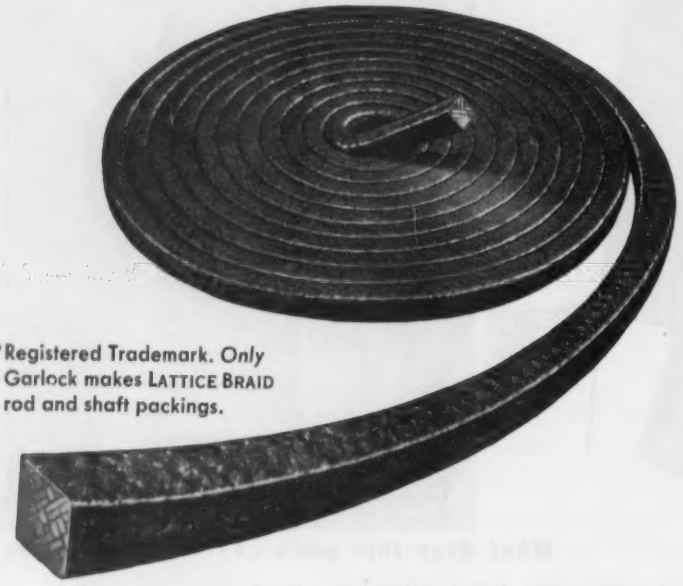
COMPANY_____

ADDRESS_____

CITY_____ ZONE_____ STATE_____

Also Produced in
OTHER ALLIED PLANTS
SPECIAL COLD FORGED PARTS
STANDARD CAP SCREWS
PRECISION GROUND PARTS
SHEET METAL DIES
MADE OF FERROUS ALLOYS,
ZINC ALLOYS OR PLASTICS

United Towing Co. reports LATTICE BRAID* *outlasts* previous pump packings 26 to 1



*Registered Trademark. Only Garlock makes LATTICE BRAID rod and shaft packings.

United Towing Company of Wilmington, Cal. tried a number of packings on their rotary gear pumps handling *cold molasses* and operating at 120 p.s.i. In starting the pumps, the cold molasses would ruin these packings. In fact, no packing would last more than 8 to 10 hours. That is, until United Towing tried rugged LATTICE BRAID asbestos packing with wire insertion and wire corners. In actual running time, LATTICE BRAID has lasted for 260 hours—26 times longer than any previous packing.

Put Garlock LATTICE BRAID Packing to work for your company. All the braided strands of this unique packing are lattice linked together into one structural unit. The strands hold together even when the packing is worn far beyond the limits of wear of ordinary braided packings.

LATTICE BRAID is made from flax, cotton, asbestos, wire-inserted asbestos, Teflon, and asbestos with Teflon impregnation—for various types of services.

Get all the facts about LATTICE BRAID *Packings. Contact your Garlock representative or write for new folder AD-131.*

THE GARLOCK PACKING COMPANY, PALMYRA, NEW YORK

Sales Offices and Warehouses: Baltimore • Birmingham • Boston • Buffalo • Chicago • Cincinnati • Cleveland Denver • Detroit • Houston • Los Angeles • New Orleans • New York City • Palmyra (N. Y.) • Philadelphia Pittsburgh • Portland (Oregon) • Salt Lake City • San Francisco • St. Louis • Seattle • Spokane • Tulsa.

In Canada: The Garlock Packing Company of Canada Ltd., Toronto, Ont.

GARLOCK LATTICE BRAID PACKING

REELS, Stock, Standard and Automatic
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

REFRACTORS, Heat-Treating Furnace
Norton Co., 1 New Bond St., Worcester 6, Mass.

REGULATORS, Temperature
General Electric Co., Schenectady, N. Y.

REMOVERS, Japan, Enamel, Etc.
Oakite Products, Inc., 19 Rector St., New York, N. Y.

RETAINING RINGS FOR BEARINGS, Etc.
Nice Ball Bearing Co., Nicetown, Philadelphia, Pa.
Wades-Kohinoor, Inc., 4716 Austel Place, Long Island City 1, N. Y.

RHEOSTATS
Allen-Bradley Co., 1326 S. 2nd St., Milwaukee, Wis.
General Electric Co., Schenectady, N. Y.

RIVET SETS
Bethlehem Steel Co., Bethlehem, Pa.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.

RIVETERS, Hydraulic
Bethlehem Steel Co., Bethlehem, Pa.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Hanna Engineering Works, 1752 Elston Ave., Chicago, Ill.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Morgan Engrg. Co., Alliance, Ohio.

RIVETERS, Pneumatic
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Grant Mfg. & Machine Co., 90 Silliman St., Bridgeport 5, Conn.
Ingersoll-Rand Co., Phillipsburg, N. J.
Keller Tool Co., Grand Haven, Mich.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Wood & Co., R. D., Public Ledger Bldg., Philadelphia, Pa.

RIVETING MACHINES
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Grant Mfg. & Machine Co., 90 Silliman St., Bridgeport 5, Conn.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Tomkins-Johnson Co., Jackson, Mich.

RIVET MAKING MACHINES
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
National Machinery Co., Greenfield and Stanton Sts., Tiffin, Ohio.

RUBBER PRODUCTS
Garlock Packing Co., Palmyra, N. Y.

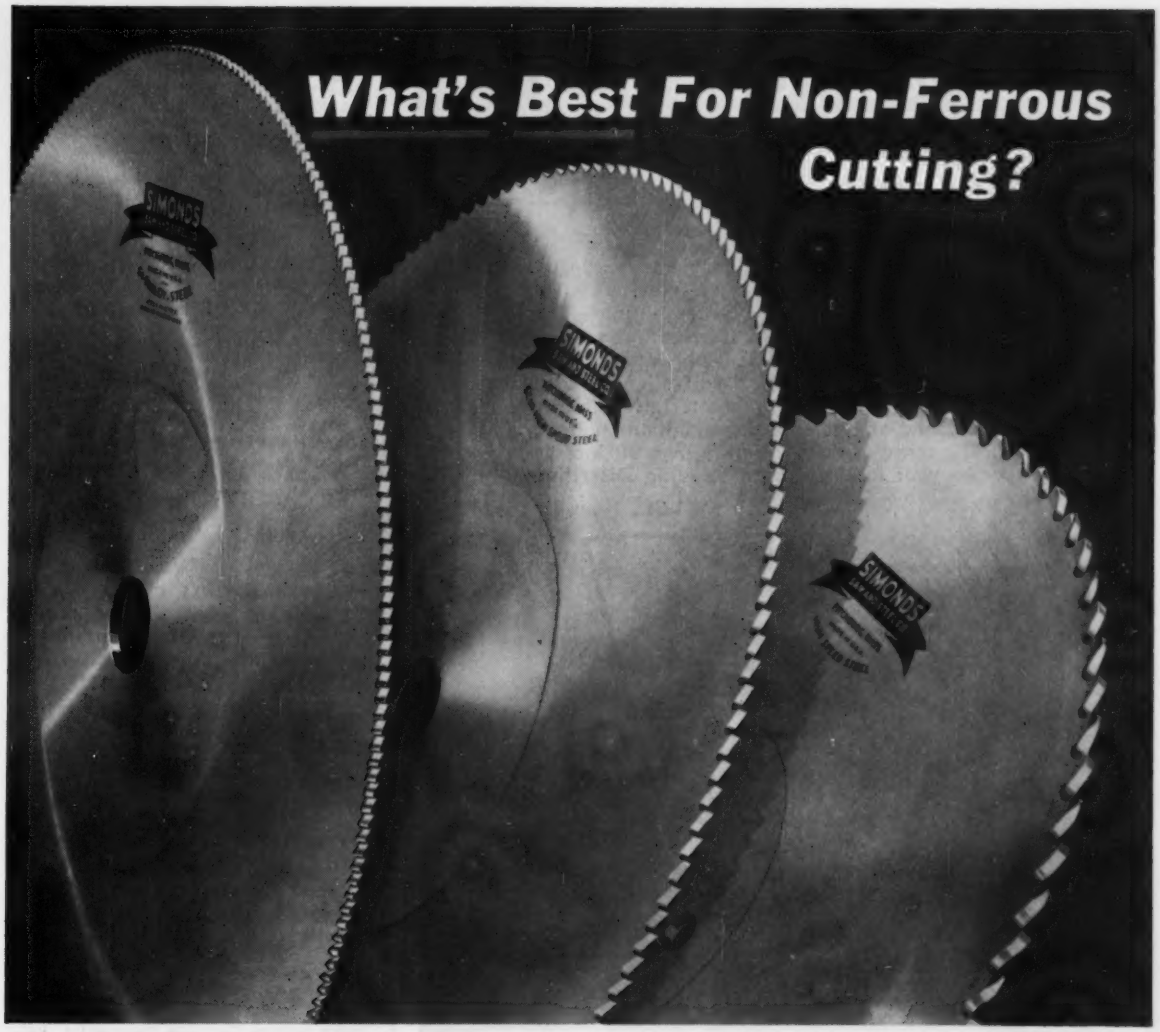
RULES, Steel
Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Millers Falls Co., Greenfield, Mass.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S. Co., Athol, Mass.

RUST PREVENTIVES
Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Oakite Products, Inc., 19 Rector St., New York, N. Y.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

SAND BLAST EQUIPMENT
See Blast Cleaning Equipment

(*Continued on page* 380)

For more information on products advertised, use Inquiry Card, page 243



SIMONDS Circular Metal Saws

SI-MALOY* STEEL SAWS, made of Simonds patented steel especially developed for sawing non-ferrous metals, provide longer cutting life, greater economy in all but the most abrasive non-ferrous alloys. Costing more than Semi-High Speed Steel Saws, they give more service between sharpenings. Costing the same as High Speed Steel Saws, they're tougher, more break-resistant and hold a cutting edge equally well. Si-Maloy Saws are clearance ground and available in a wide range of stock sizes.

SEMI-HIGH SPEED STEEL SAWS are normally applied where production requirements are limited. Tougher, more resistant to cracking, they're more economical to use on jobs where saws are subject to abuse. Furnished clearance ground or with teeth set for clearance, Semi-High Speed Saws are available in a wide range of stock sizes.

HIGH SPEED STEEL SAWS provide the ultimate in cutting life on all types of non-ferrous alloys, but won't take as much abuse as Si-Maloy Saws. Furnished clearance ground in a wide range of stock sizes. Simonds Steel, modern heat-treating, grinding and production methods insure longer, trouble-free service from every saw with the familiar Simonds ribbon trade mark. Write for Bulletin M-80 for further information.

SIMONDS
SAW AND STEEL CO.
FITCHBURG, MASS.

For quick deliveries large or small
Give your Simonds Distributor a call



*Steel Analysis Patented No. 2,204,283

Factory Branches in Boston, Chicago, San Francisco and Portland, Oregon, Canadian Factory in Montreal, Que., Simonds Division: Simonds Steel Mill, Lockport, N. Y. Simonds Abrasive Co., Phila., Pa., and Arvida, Que., Canada

For Sleeve Bearing Service see your JOHNSON DISTRIBUTOR

Virtually every need for sleeve bearings can be supplied from his large stock of Johnson Bearings. The line includes Johnson GP (General Purpose) Cast Bronze Bearings; Johnson EM Bearings for all makes of electric motors; Johnson Self-lubricating Ledaloyl Bearings in plain, flanged and self-aligning types; Johnson Graphited Bearings; Johnson Universal Bronze in 13-inch solid and cored bars; and Johnson Babbitt Metal. The range of sizes will meet over 90% of your needs. See your local Johnson Bearing Distributor.

JOHNSON BRONZE CO., 520 South Mill St., New Castle, Pa.



SANDERS

Black & Decker Mfg. Co., E. Penna Ave., Towson, Md.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Ingersoll-Rand Co., Phillipsburg, N. J.
Keller Tool Co., Grand Haven, Mich.
Kindt-Collins Co., 12653 Elmwood Ave., Cleveland 11, Ohio.
Millers Falls Co., Greenfield, Mass.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.

SAW BLADES, Hack

Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Millers Falls Co., Greenfield, Mass.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Starrett, The L. S. Co., Athol, Mass.
Victor Saw Works, Inc., Middletown, N. Y.

SAW SHARPENING MACHINES

Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
Motch & Merryweather Mchry. Co., Penton Bldg., Cleveland, Ohio.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

SAWING MACHINES, Circular

Consolidated Mch. Tool Corp., Rochester, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
Motch & Merryweather Mchry. Co., Penton Bldg., Cleveland, Ohio.

SAWING MACHINES, Friction

DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.

SAWING MACHINES, Metal Cutting Band

Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Famco Machine Co., 3134 Sheridan Rd., Kenosha, Wis.
Grob, Inc., Grafton, Wis.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Walker-Turner Div., Kearney & Trecker Corp., South Ave., Plainfield, N. J.

SAWING MACHINES, Power Hack

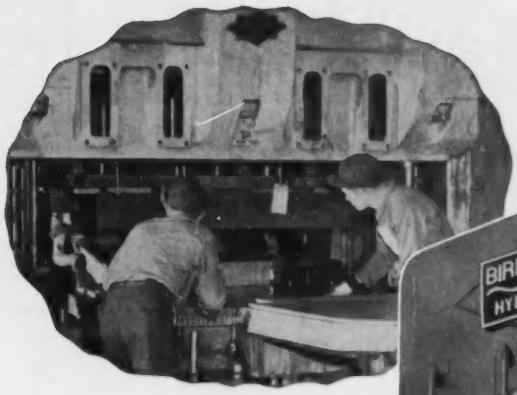
Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
Austin Industrial Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Ryerson, Joseph T., & Son Inc. 2558 W. 16th St., Chicago 18, Ill.
Victor Saw Works, Inc., Middletown, N. Y.

SAWS, Circular Metal Cutting

Alina Corp., 401 Broadway, New York 13, N. Y. (Portable).
Brown & Sharpe Mfg. Co., Providence, R. I.
Consolidated Mch. Tool Corp., Rochester, N. Y.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Johnson Mfg. Co., Albion, Mich.
Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Motch & Merryweather Mchry. Co., Penton Bldg., Cleveland, Ohio.
National Twist Drill & Tool Co., & Winter Bros., & Co., Rochester, Mich.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Union Twist Drill Co., Athol, Mass.
Walker-Turner Div., Kearney & Trecker Corp., 900 North Ave., Plainfield, N. J.

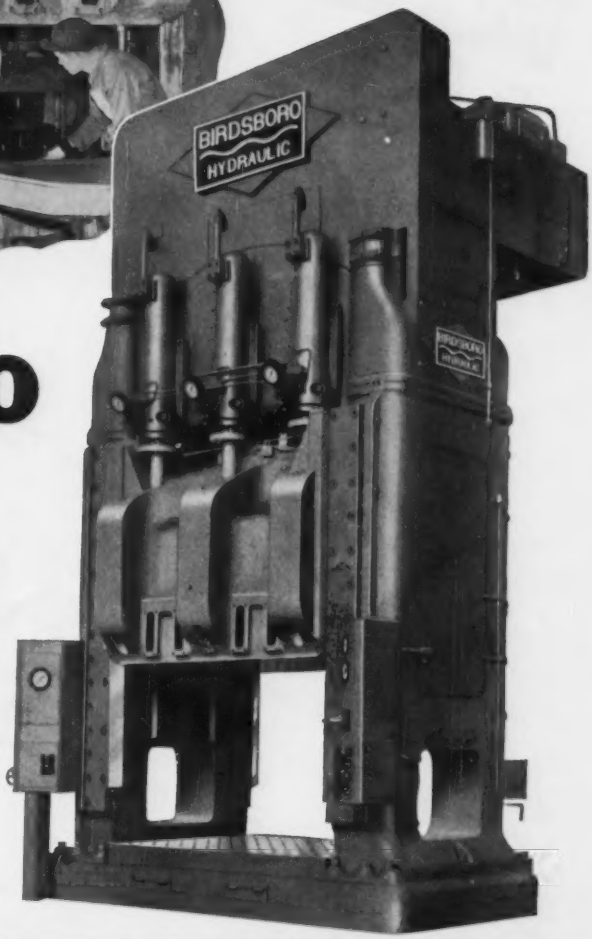
(*Continued on page 382*)

For more information on products advertised, use Inquiry Card, page 243



For DEFENSE NEEDS

For CIVILIAN GOODS



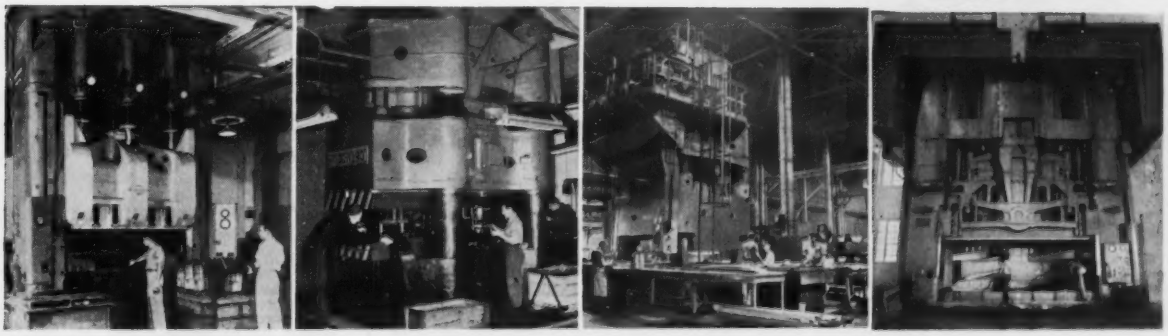
You Can Count On
BIRDSBORO
HYDRAULIC PRESSES

For HIGH PRODUCTION and SMOOTH OPERATION . . .

Birdsboro design-engineers are ever alert to production trends and are prepared to meet today's urgent demand for greater productive efficiency.

Shown here, *at work*, are a few of the many examples of Birdsboro's engineering achievements . . . hydraulic presses engaged in the important "double duty" of providing the gigantic requirements of our defense and civilian economy.

If your production problems involve hydraulic means, you can count on Birdsboro engineers to provide the proper solution.



designed & built by **BIRDSBORO**

HP 11-51R

BIRDSBORO STEEL FOUNDRY & MACHINE CO., BIRDSBORO, PENNA. HYDRAULIC PRESSES

Offices in Birdsboro, Pa. and Pittsburgh, Pa.

designers and builders of: Hydraulic Presses • Steel Mill Machinery • Crushing Machinery • Rolls • Special Machinery • Steel Castings

For more information on products advertised, use Inquiry Card, page 243

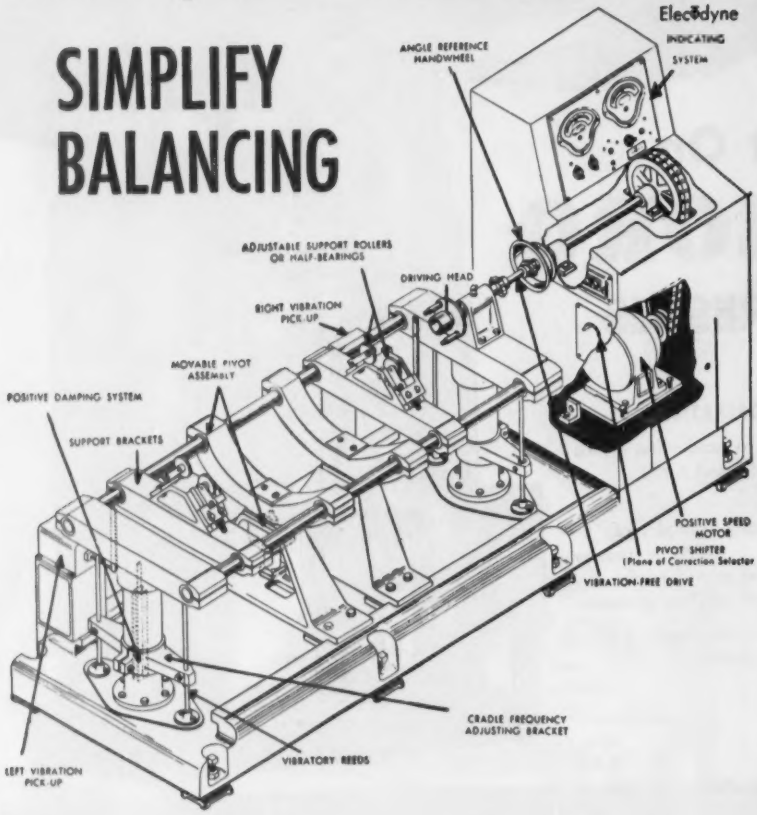
From Every Angle

OLSEN

Elec⊕dyne

Static-Dynamic Balancing Machines

SIMPLIFY BALANCING



- Automatic Angle and Amount Indication with the Elec⊕dyne electronic indicating system—an Olsen exclusive.
- Easy Operation. Operator merely inserts the part and starts the machine. In a matter of seconds he knows the amount and angle of unbalance in both planes of correction.
- Positive Plane Separation. Exclusive Tinius Olsen pivoted cradle design assures positive plane separation. Only unbalance in the selected plane of correction is indicated.
- Simplicity of Calibration. Both the Angle and Amount Meters can be calibrated quickly with the aid of a screw driver. Expensive "masters" and trial and error methods to obtain a "zero" balance are eliminated.

These are just a few of the advanced features of Tinius Olsen Balancing Machines. Details are given in Bulletin 49, a copy of which will be sent upon request.

TINIUS ⊕ OLSEN

Testing & Balancing Machines

TINIUS OLSEN TESTING MACHINE CO.

2080 Easton Road · Willow Grove, Pa.

SAWS, Metal Cutting Band

Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
Delta Power Tool Div., Rockwell Mfg. Co. 614G N. Lexington Ave., Pittsburgh 8, Pa.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Johnson Mfg. Co., Albion, Mich.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Starrett, The L. S., Co., Athol, Mass.
Walker-Turner Div., Kearney & Trecker Corp., 900 North Ave., Plainfield, N. J.

SAWS, Portable Electric

Black & Decker Mfg. Co., Penna. Ave., Towson, Md.
Millers Falls Co., Greenfield, Mass.

SAWS, Screw Slotting

Barber-Colman Co., Rock and Montague, Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
National Twist Drill & Tool Co., & Winter Bros. Co., Rochester, Mich.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Starrett, The L. S., Co., Athol, Mass.
Union Twist Drill Co., Athol, Mass.

SCRAPERS, Hand and Power

Anderson Bros. Mfg. Co., 1910 Kishwaukee St., Rockford, Ill.

SCREW DRIVERS, Power

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.
Keller Tool Co., Grand Haven, Mich.

SCREW DRIVING AND NUT SETTING EQUIPMENT

Black & Decker Mfg. Co., E. Penna. Ave., Towson, Md.
Errington Mechanical Laboratory, Inc., 24 Norwood Ave., Stapleton, S. I., N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.
Keller Tool Co., Grand Haven, Mich.

SCREW MACHINE TOOLS AND EQUIPMENT

Bardons & Oliver, Inc., Ft. W. 9th St., Cleveland 13, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Colonial Broach Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Greenlee Bros. & Co., 12th and Columbia Aves., Rockford, Ill.
Millers Falls Co., Greenfield, Mass.
National Acme Co., 170 E. 131st St., Cleveland.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Potter & Johnston Co., 1027 Newport Ave., Pawtucket, R. I.
R and L Tools, 1825 Bristol St., Philadelphia 40, Pa.
Reed Rolled Thread Die Co., P. O. Box 350, Worcester 1, Mass.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

SCREW MACHINE WORK

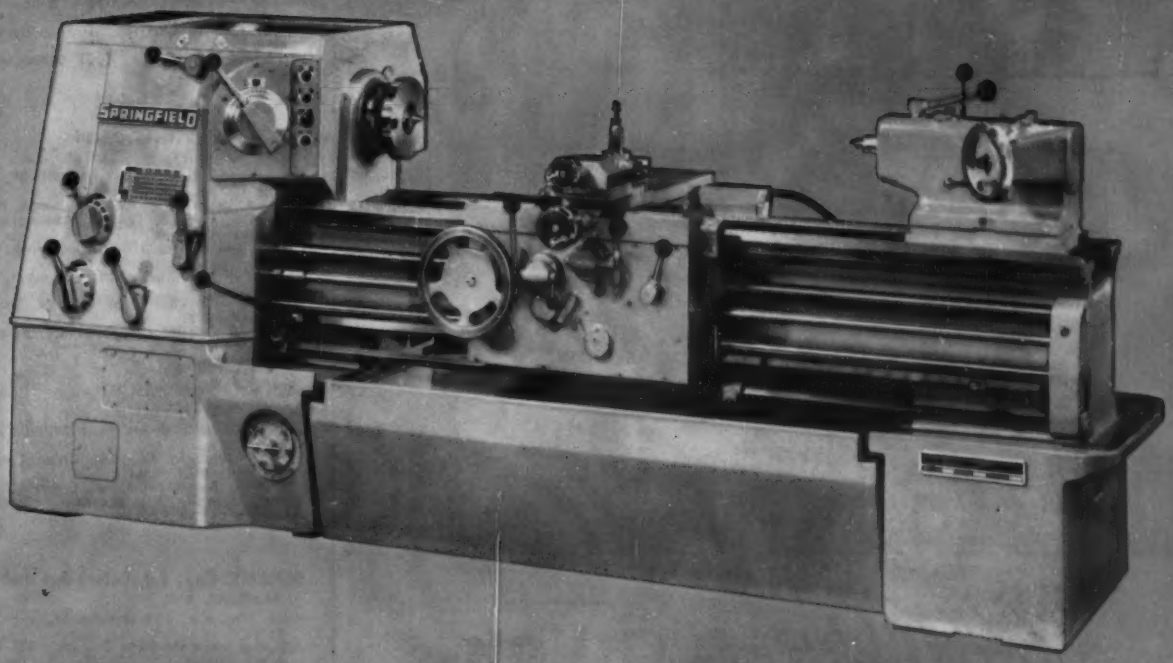
Eastern Mch. Screw Corp., New Haven, Conn.
Mueller Brass Co., Port Huron 35, Mich.
National Acme Co., 170 E. 131st St., Cleveland.
Ottemiller, W. H., Co., York, Pa.
Standard Pressed Steel Co., Jenkintown, Pa.
Wicaco Machine Corp., Stenton Ave., and Louden St., Philadelphia, Pa.

SCREW MACHINES, Automatic Single and Multiple Spindle

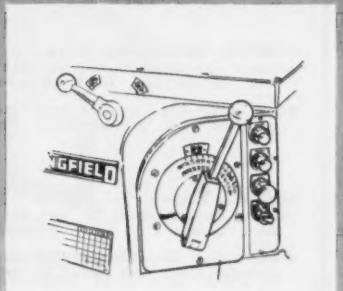
Brown & Sharpe Mfg. Co., Providence, R. I.
Cone Automatic Mch. Co., Inc., Windsor, Vt.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wisc.
Greenlee Bros. & Co., 12th and Columbia Aves., Rockford. Ill.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.

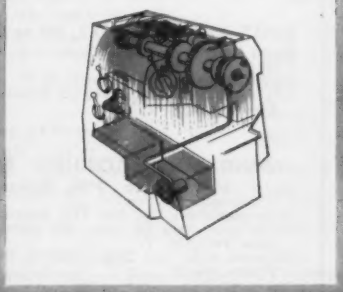
(*Continued on page* 384)

For more information on products advertised, use Inquiry Card, page 243



because it's simple





It does more work. Operators produce more with less fatigue because of Springfield's simple, responsive, easy-to-reach controls. *It runs cooler.* Continuous oil-mist lubrication carries heat away; cooler head minimizes distortion, maximizes accuracy. *It saves power, cuts wear.* Only the gears necessary for the selected speed are engaged; other gears run free. *It makes maintenance easy.* Clean design cuts maintenance time, promotes better shop practices.

Engine and toolroom lathes: swings 14" to 32".

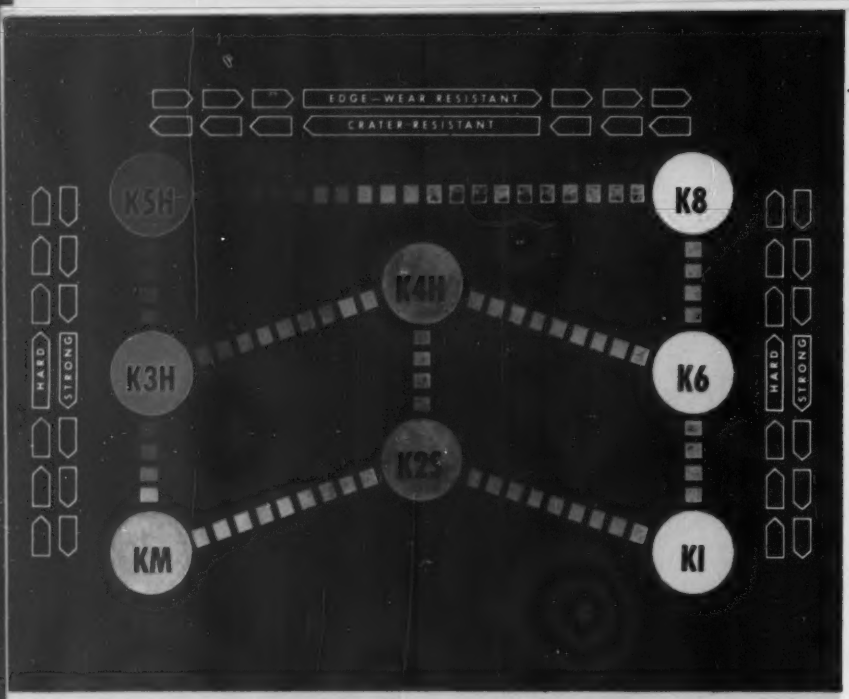
Contouring and reproducing lathes: swings 14" to 32".

Universal vertical grinders: swings 21" to 52".

Write for the name of your Springfield dealer.

THE SPRINGFIELD MACHINE TOOL CO., SPRINGFIELD, OHIO

Springfield



NOW- A Quick, Easy-to-Use Guide to Efficient Machining

Here's the first simplified system for selecting carbide tool grades. Kennametal's new grade selection method assures top tool performance on every machining job. It's easy to use and eliminates guesswork because grades are grouped according to their wear characteristics (edge-wear and crater-resistant); also according to relative strength with strong, intermediate and hard grades included in each group. These eight Kennametal grades meet all machining requirements.

Kennametal's grading system is unmatched in the industry for simplicity. Any experienced machinist can use it to quickly adjust grades for better tool performance. For example: If K3H is being used and crater is no problem, a switch to K4H, which is more edge-wear resistant, will provide longer tool life. Conversely, if K4H is being used and crater is excessive, a switch to K3H would improve tool life.

Your Kennametal representative will gladly help you apply this grade selection system to your machining operations. He can also help apply these eight grades to "wear spots" in your product, your processing lines, or any place a hard, wear-resistant metal is needed. Just give him a call. Kennametal Inc., Latrobe, Pa.

*Registered Trade Marks



KENNAMETAL
CEMENTED CARBIDE TOOLING
THAT INCREASES PRODUCTIVITY

SALES OFFICES IN PRINCIPAL CITIES

A-15

National Acme Co., 170 E. 131st St., Cleveland, Ohio.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

SCREW MACHINES, Hand
See also Lathes, Turret
Bardons & Oliver, Inc., Ft. W. 9th St., Cleveland 13, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Hardinge Bros., Inc., 1418 College Ave., Elmira, N. Y.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Simmons Mch. Tool Corp., 1600 N. Broadway, Albany, N. Y.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

SCREW PLATES
Butterfield Div., Union Twist Drill Co., Derby Line, Vt.
Card, S. W., Mfg. Co., Div. Union Twist Drill Co., Mansfield, Mass.
Greenfield Tap & Die Corp., Greenfield, Mass.
Pratt & Whitney, West Hartford 1, Conn.
Winter Bros. Co., Rochester, Mich.

SCREWS, Cap, Set, Safety Set and Machine, Etc.
Allen Mfg. Co., 133 Sheldon St., Hartford 2, Conn.
Allmetal Screw Products Co., Inc., 821 Stewart Ave., Garden City, N. Y. (Stainless Steel only.)
Chicago Screw Co., Bellwood, Ill.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Ottemiller, W. H., Co., York, Pa.
Parker-Kalon Div., General American Transportation Corp., 200 Varick St., New York, N. Y.
Republic Steel Corp., Bolt & Nut Div., Republic Bldg., Cleveland 1, Ohio.
Russell, Burdsall & Ward Bolt & Nut Co., 100 Midland Ave., Port Chester, N. Y.
Standard Pressed Steel Co., Jenkintown, Pa.

SCREWS, Self-tapping, Drive
Allmetal Screw Products Co., Inc., 821 Stewart Ave., Garden City, N. Y. (Stainless Steel only.)
Parker-Kalon Div., General American Transportation Corp., 200 Varick St., New York, N. Y.

SCREWS, Thumb
Allmetal Screw Products Co., Inc., 821 Stewart Ave., Garden City, N. Y. (Stainless Steel only.)
Parker-Kalon Div., General American Transportation Corp., 200 Varick St., New York, N. Y.
Russell, Burdsall & Ward Bolt & Nut Co., 100 Midland Ave., Port Chester, N. Y.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

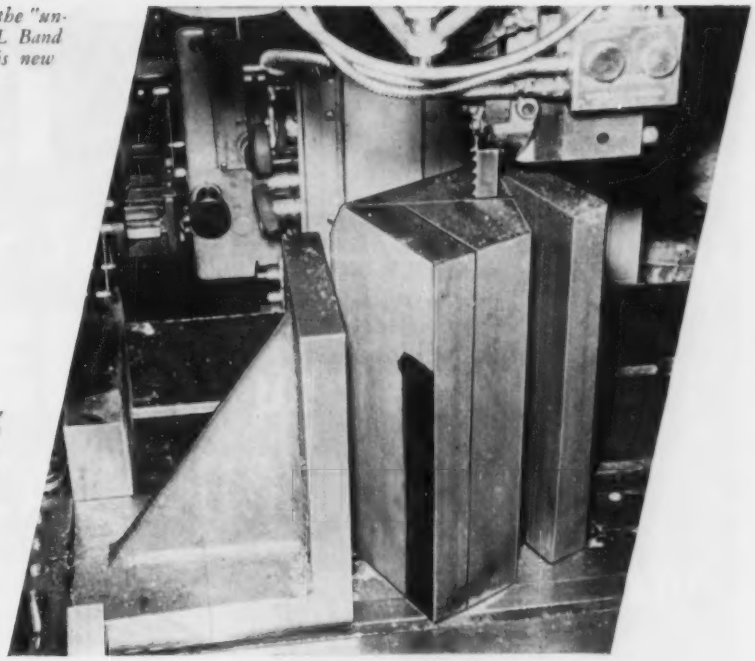
SEALS AND RETAINERS, Oil or Grease
Crane Packing Co., 1800 Cuyler Ave., Chicago, Ill.
Garlock Packing Co., Palmyra, N. Y.
Gits Bros. Mfg. Co., 1846-62 Kilbourn Ave., Chicago, Ill.

SECOND-HAND MACHINERY, Etc.
Eastern Machinery Co., 1006 Tennessee Ave., Cincinnati 22, Ohio.
Miles Machinery Co., Box 770, Saginaw, Mich.
Morey Machinery Co., Inc., 383 Lafayette St., New York, N. Y.
Simmons Mch. Tool Corp., 1600 N. Broadway, Albany, N. Y.

SEPARATORS, Centrifugal
De Laval Separator Co., Poughkeepsie, N. Y.
The Sharples Corp., 2300 Westmoreland St., Philadelphia 40, Pa.

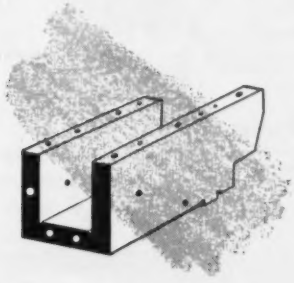
(Continued on page 386)

One of a series of advertisements explaining the "unrestricted geometry" of cutting with DoALL Band Machines and how industry is applying this new concept.



• *This slotting operation, performed in 72 minutes on a DoALL band machine, formerly took 325 minutes on a milling machine.*

A new machining concept to cut your production costs!



TIME SAVING: 7 hours, 3 minutes. Total band machining time on this part (slotting and cutting the end) is 3 hours, 12 minutes. Performing the same operations on a milling machine took 10 hours, 25 minutes.

How would your plant machine 100 duplicates of the part illustrated above? You are seeing it being made on a power feed DoALL band machine at about ⅓ the cost of milling, the previous method used.

Production band machining has come of age, with new *high speed steel* blades that last for more than 3000 square inches of cutting and cut up to five times faster than previous blades. The work is positioned on the hydraulically powered table and automatically fed into the continuous-cutting saw band. A built-in coolant system permits high cutting rates. Variable speeds and feeds and a wide range of different blades provide optimum production and finish. Machine tool accuracy is obtained.

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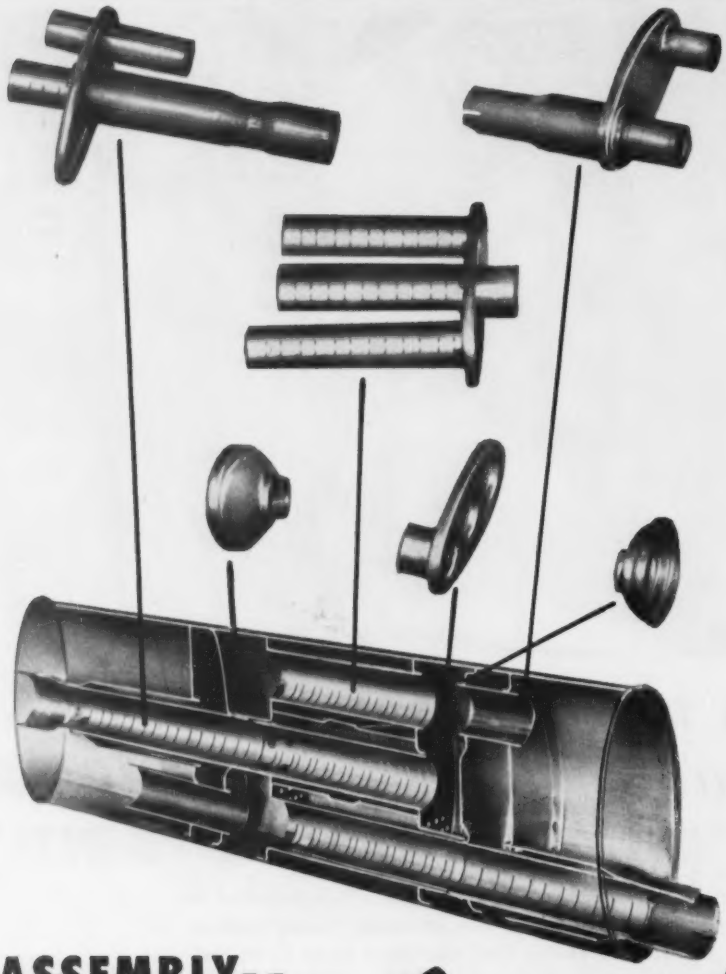


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(*Continued on page 390*)

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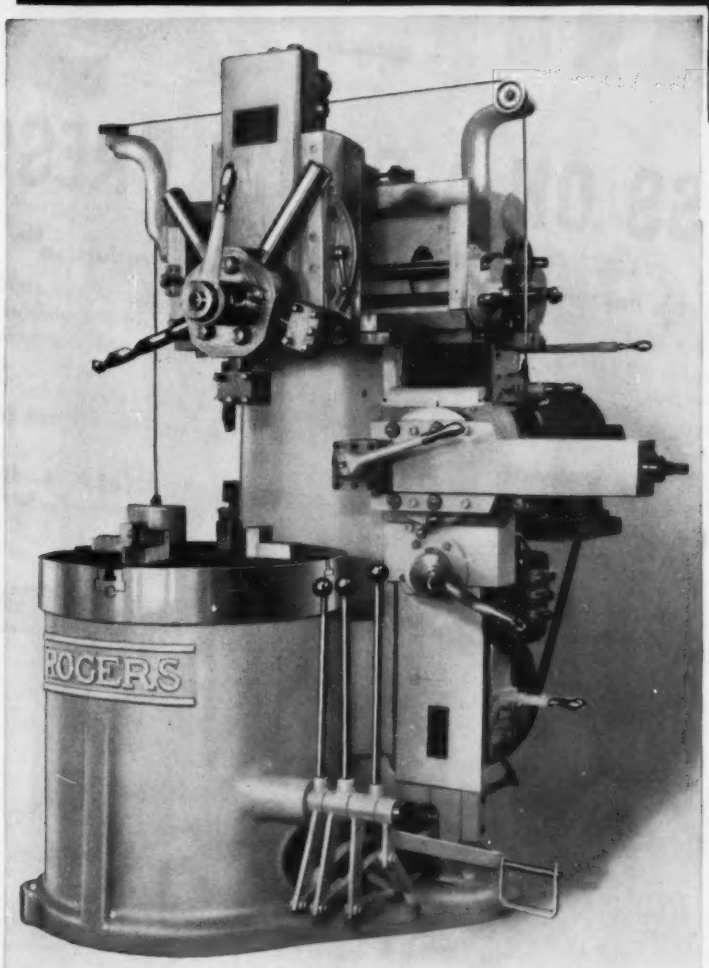
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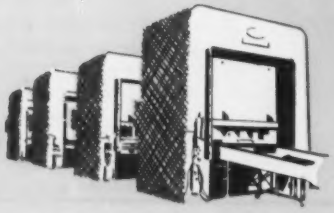
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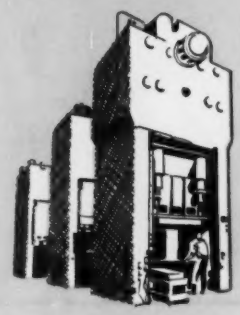
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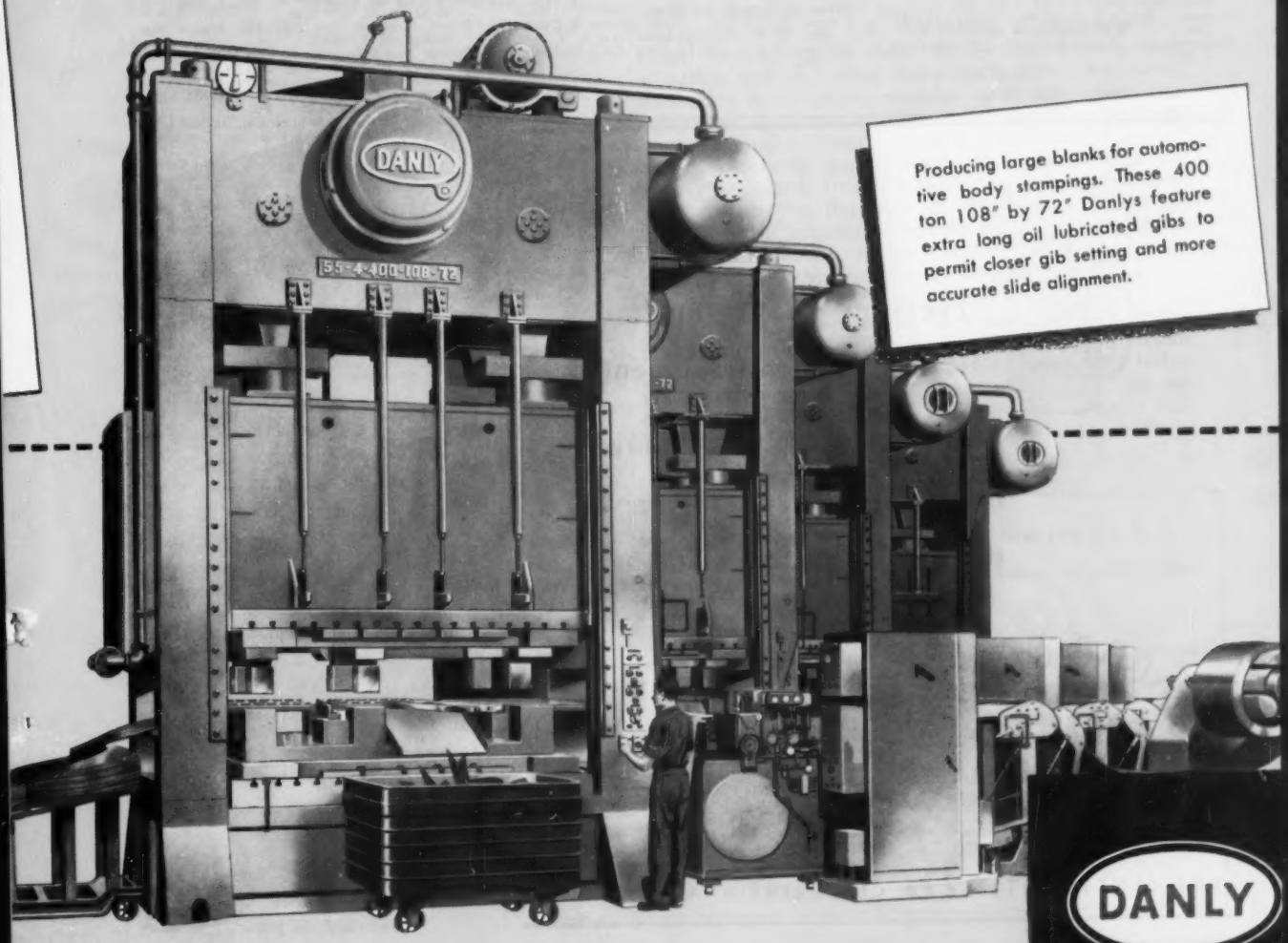




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(*Continued on page* 392)



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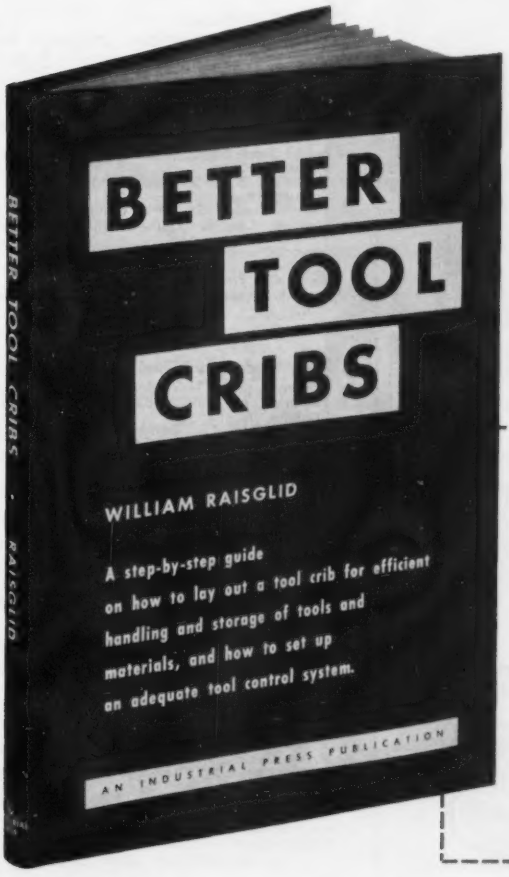
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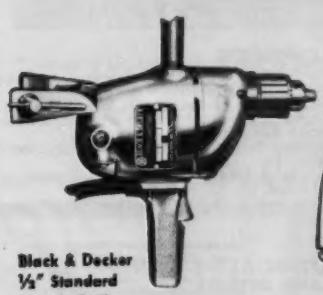
Hall-Neal manufactures furnaces, installs them and air-conditioning equipment. Photo shows ¼" B&D Drill used to drill hole in 22 gauge steel. Also used for general maintenance. The use of the drill has resulted in 100% speed up in operation and production. Company also uses B&D Screwdriver, Heavy Duty Grinder. Some on job 8 hours a day, 5½ days a week for 10 years.

Jim – Note this proof of long trouble-free service

Here's power to drive drills (and saws, grinders, hammers, screwdrivers) . . . produce more per machine . . . per man-hour.

Here's power *custom-built* for the job. Power built into every B&D Portable Electric Tool because every B&D Tool is driven by a B&D-built motor. And every B&D Tool is built to the latest design with husky housings, precision parts. Year in, year out you can depend on B&D Tools to do the job faster . . . saving time, trouble, money, and manpower.

Don't just take our word for it. Ask around industry. Ask production specialists. Ask time and motion experts. Then try Black & Decker Drills . . . Black & Decker Power. See your B&D Distributor for demonstration. And write today for free, detailed catalog. Address: THE BLACK & DECKER MFG. CO., 605 Pennsylvania Ave., Towson 4, Maryland.



Black & Decker ½" Standard Electric Drill



Black & Decker ¼" Heavy-Duty HOLGUN* Drill

LEADING DISTRIBUTORS EVERYWHERE SELL

Black & Decker

PORTABLE ELECTRIC TOOLS

B&D

* Trade Mark Reg. U. S. Pat. Off.

STEEL, Stainless
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
American Steel & Wire Co., Div. U. S. Steel Corp., Rockefeller Bldg., Cleveland, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Timken Roller Bearing Co., Canton, Ohio.
U. S. Steel Corp. (American Steel & Wire Co. Div., Carnegie-Illinois Steel Corp. Div.), 436 7th Ave., Pittsburgh, Pa.
Wheelock-Lovejoy & Co., Inc., Cambridge, Mass.

STEEL, Strip and Sheet
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
American Steel & Wire Co., Div. U. S. Steel Corp., Rockefeller Bldg., Cleveland, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp. (American Steel & Wire Co. Div., Carnegie-Illinois Steel Corp. Div., Columbia Steel Co. Div., Tennessee Coal, Iron & R. R. Co. Div.), 436 7th Ave., Pittsburgh, Pa.

STEEL, Tool and Die
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Carpenter Steel Co., Reading, Pa.
Columbia Tool Steel Co., Lincoln Hwy. & State St., Chicago Heights, Ill.
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Vanadium Alloys Steel Co., Latrobe, Pa.

STEEL, Zinc, Tin and Copper Coated Strip
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.

STEEL ALLOYS
See Alloys, Steel

STEEL BARS
See Bars, Steel

STEEL STOCK GROUND FLAT
Brown & Sharpe Mfg. Co., Providence, R. I.
Starrett, The L. S., Co., Athol, Mass.
Summerill Tubing Co., Div. Columbia Steel & Shafting Co., P. O. Box 1557, Pittsburgh, Pa.

STELLITE
Haynes Stellite Div., Union Carbide & Carbon Corp. (Alloy), 30 E. 42nd St., New York, N. Y.

STOCK STOPS
Wohlnip Engineering Co., 390 Hillside Ave., Hillside, N. J.

STOCKS, Die
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Butterfield Div., Union Twist Drill Co., Derby Line, Vt.
Card, S. W., Mfg. Co., Div. of Union Twist Drill Co., Mansfield, Mass.
Greenfield Tap & Die Corp., Greenfield, Mass.
Pratt & Whitney, West Hartford 1, Conn.

STONES, Oil or Sharpening
Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
Norton Co., 1 New Bond St., Worcester 6, Mass.

STOOLS
Standard Pressed Steel Co., Jenkintown, Pa.

STRAIGHTEDGES
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

STRAIGHTENERS, Flat Stock and Wire
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

STRAIGHTENING MACHINERY
American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Chambersburg Engrg. Co., Chambersburg, Pa.
Colonial Broach Co., P.O. Box 37, Harper Sta., Detroit 13, Mich.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4, Wis.
Springfield Mch. Tool Co., Springfield, Ohio.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.

STUD SETTERS
Errington Mechanical Laboratory Inc., 24 Norwood Ave., Stapleton, S. I., N. Y.
Procunier Safety Chuck Co., 18 S. Clinton St., Chicago, Ill.

SUB-PRESSES
Waltham Machine Works, Newton St., Waltham, Mass.

SUPERFINISHING MACHINES
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.

SURFACE PLATES
See Plates, Surface

SWAGING MACHINES
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Torrington Co., Torrington, Conn.

SWITCHES
Allen-Bradley Co., 1326 S. 2nd St., Milwaukee, Wis
Central Products, Inc., (Waterproof and Thermal), 306 Sussex St., Harrison, N. J.
General Electric Co., Schenectady, N. Y.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.

TACHOMETERS
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

TAPER PINS, Standard
Alimetal Screw Products Co., Inc., 821 Stewart Ave., Garden City, N. Y. (Stainless Steel only).
Chicago Screw Co., Bellwood, Ill.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Gillen, John, Co., Inc., 2540 S. 50th Ave., Cicero 50, Ill
Pratt & Whitney West Hartford 1, Conn.

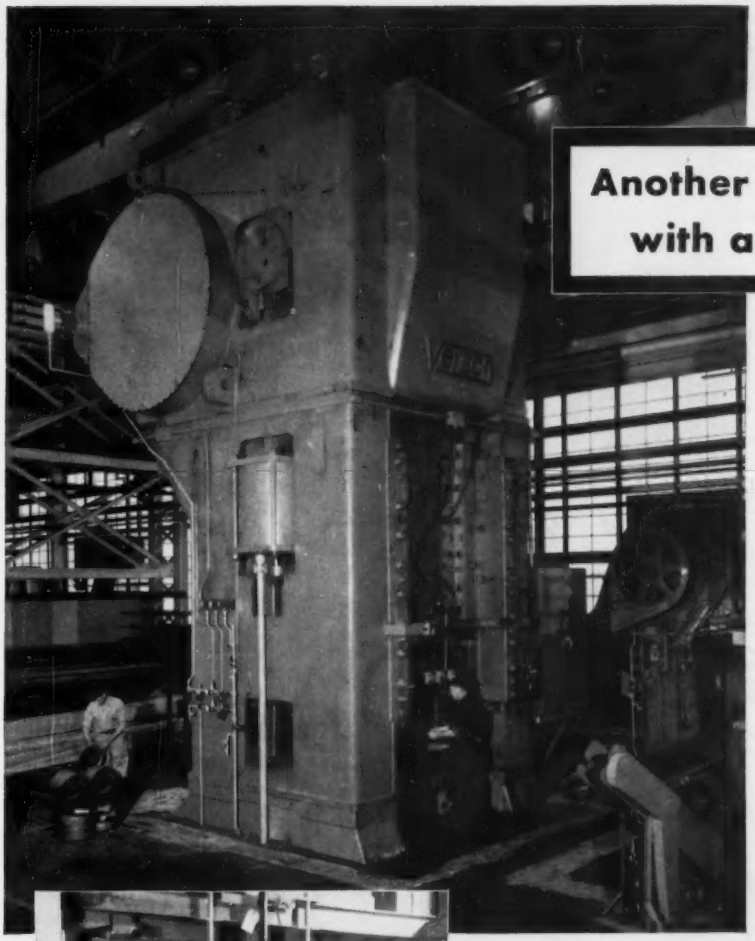
TAP HOLDERS
Burg Tool Mfg. Co., 3743 Durango Ave., Los Angeles 34, Cal.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Errington Mechanical Laboratory, Inc., 24 Norwood Ave., Stapleton, S. I., N. Y.
McCrosky Tool Co., 1938 Thomas St., Meadville, Pa.
Procunier Safety Chuck Co., 18 S. Clinton St., Chicago, Ill.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.

TAPPING ATTACHMENTS AND DEVICES
Avey Drilling Mach. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.

(*Continued on page 396*)

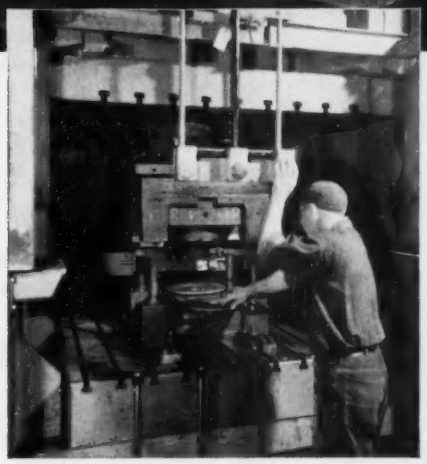


For more information on products advertised, use Inquiry Card, page 243



Another job done better with a Verson press

THIS Verson 2500 TON FULL ECCENTRIC PRESS forms automotive flywheels



Close-up of the die space in this 2500 ton Verson Full Eccentric Press showing the part being formed.

If you want to combine the highest standards of accuracy and uniformity in stampings with long, dependable, trouble-free press life, a Verson Full Eccentric Press is the answer. Verson Full Eccentrics incorporate the sum of over thirty years' experience in the manufacture of rugged high strength presses designed to produce better stampings at lower cost.

Such features as the Verson Allsteel Frame . . . the Verson full eccentric drive . . . straight thrust eccentric strap . . . extra long, barrel type, non-oscillating vertical adjusting screw . . . anti-overlap clutch and brake unit put Verson Full Eccentrics in a quality class by themselves.

The press shown above is typical of Verson Full Eccentric Presses. It is being used to form heavy flywheels on a high production basis. Note the long, extra heavy special gibbing and rugged construction throughout—assurance of the accuracy and uniformity required in a part like this.

The Verson Full Eccentric line includes models with one, two and four point suspension in capacities from 100 tons up. Further data is given in Catalog G-52. Write for your copy.

A Verson Press for every job from 60 tons up.

Verson

ORIGINATORS AND PIONEERS OF ALLSTEEL STAMPING PRESS CONSTRUCTION

VERSON ALLSTEEL PRESS CO.

9309 S. KENWOOD AVENUE, CHICAGO 19, ILLINOIS • SO. LAMAR AT LEDBETTER DRIVE, DALLAS, TEXAS

MECHANICAL AND HYDRAULIC PRESSES AND PRESS BRAKES • TRANSMAT PRESSES • TOOLING • DIE CUSHIONS • VERSON-WHEELON HYDRAULIC PRESSES

Baptist Machine Co., Inc., 36 Ludlow St., Stamford, Conn.
Brown & Sharpe Mfg. Co., Providence, R. I.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Errington Mechanical Laboratory, Inc., 24 Norwood Ave., Stapleton, S. I., N. Y.
Ettco Tool Co., Inc., 592 Johnson Ave., Brooklyn, N. Y.
Leland-Gifford Co., 1425 Southbridge St., Worcester, Mass.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
Procunier Safety Chuck Co., 18 S. Clinton St., Chicago, Ill.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Thriftmaster Products Corp., 1076 N. Plum St., Lancaster, Pa.

TAPPING MACHINES

Avey Drilling Mach. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Baush Machine Tool Co., 156 Wasson Ave., Springfield 7, Mass.
Bodine Corp., 317 Mt. Grove St., Bridgeport, Conn.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
Challenge Mchry. Co., Grand Haven, Mich.
Cleveland Tapping Machine Co., Canton 6, Ohio.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Greenlee Bros. & Co., 12th and Columbia Aves., Rockford, Ill.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Kaufman Manufacturing Co., Manitowoc, Wis.
Kingsbury Mch. Tool Corp., Keene, N. H.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Procunier Safety Chuck Co., 18 S. Clinton St., Chicago, Ill.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

TAPPING MACHINES, Nut

Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
National Machinery Co., Greenfield and Stanton Sts., Tiffin, Ohio.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.

TAPS

Butterfield Div., Union Twist Drill Co., Derby Line, Vt.
Card, S. W., Mfg. Co., Div. Union Twist Drill Co., Mansfield, Mass.
Continental Tool Works, Div. Ex-Cell-O. Corp., Detroit 32, Mich.
Detroit Tap & Tool Co., 8615 E. 8 Mile Rd., Base Line, Mich.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Geometric Tool Co., Westville Station, New Haven 15, Conn.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hanson-Whitney Co., Div. Whitney Chain Co., Hartford, Conn.
Iroquois Corp., RFD 4 Box 331, 1800 E. 11 Mile Rd., Royal Oak, Mich.
Landis Mch. Co. (Solid Adjustable), Waynesboro, Pa.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Winter Bros. Co., Rochester, Mich.
Wood & Spencer Co., 1930 E. 61st St., Cleveland, Ohio.

TAPS, Collapsing

Geometric Tool Co., Westville Station, New Haven 15, Conn.
Landis Mch. Co., Waynesboro, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Sheffield Corp., 721 Springfield, Dayton, Ohio.

TESTING EQUIPMENT, Tension, Compression, Fatigue, etc.

Olsen Tinius, Testing Machine Co., Philadelphia, Pa.

THREAD CUTTING MACHINERY

Brown & Sharpe Mfg. Co., Providence, R. I.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Coulter, James, Machine Co., Bridgeport 5, Conn.
Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Eastern Mch. Screw Corp., New Haven, Conn.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Grant Mfg. & Mch. Co., 90 Silliman St., Bridgeport 5, Conn.
Hanson-Whitney Co., Div. Whitney Chain Co., Hartford, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Kaufman Manufacturing Co., Manitowoc, Wis.
Landis Mch. Co., Waynesboro, Pa.
Pratt & Whitney, West Hartford 1, Conn.
Procunier Safety Chuck Co., 18 S. Clinton St., Chicago, Ill.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

THREAD CUTTING TOOLS

Armstrong Bros. Tool Co., 5200 Armstrong Ave., Chicago, Ill.
Detroit Tap & Tool Co., 8615 E. 8 Mile Rd., Base Line, Mich.
Eastern Mch. Screw Corp., New Haven, Conn.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Geometric Tool Co., Westville Station, New Haven 15, Conn.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Hanson-Whitney Co., Div. Whitney Chain Co., Hartford, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Landis Mch. Co., Waynesboro, Pa.
Pratt & Whitney, West Hartford 1, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

THREAD GAGES

See Gages, Thread.

THREAD GRINDING MACHINES

See Grinding Machines, Thread

THREAD MILLING MACHINES

Coulter, James, Machine Co., Bridgeport 5, Conn.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Hanson-Whitney Co., Div. Whitney Chain Co., Hartford, Conn.
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Waltham Machine Works, Newton St., Waltham, Mass.

THREAD ROLLING HEADS

National Acme Co., 170 E. 131st St., Cleveland, Ohio.

THREAD ROLLING MACHINES

Landis Machine Co., Waynesboro, Pa.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Reed Rolled Thread Die Co., P. O. Box 350, Worcester 1, Mass.

TIN AND TERNEPLATES

Bethlehem Steel Co., Bethlehem, Pa.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
U. S. Steel Corp., (Carnegie-Illinois Steel Corp., Div., Columbia Steel Co., Div., Tennessee Coal, Iron & R. R. Co., Div.), 436 7th Ave., Pittsburgh, Pa.

TOOL BITS, High Speed Steel

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.

(*Continued on page 398*)

NOW! improved delivery

OF GRAND RAPIDS UNIVERSAL CUTTER AND TOOL GRINDERS



Get the full story on all the advantages

It's true, they have been hard to get because every model offers extra value.

The Model 62, for instance, features four-speed spindle drive, universal positioning of elevating hand wheel, anti-friction ways, more vertical capacity, longer swing, one-shot lubrication system.

The many other Grand Rapids Cutter Grinders are also on improved delivery schedules. Send coupon for complete information.

GALLMEYER & LIVINGSTON CO.
425 Straight Ave., Grand Rapids, Mich.
Please send me the following literature without obligation:
☐ Cutter and Grinder Literature
☐ Surface Grinder Literature
NAME
POSITION
FIRM
FIRM ADDRESS
We'll answer within twenty-four hours

GALLMEYER & LIVINGSTON

For more information on products advertised, use Inquiry Card, page 243



Hired for one job— this DENISON MULTIPRESS® does 21 more

INTERCHANGEABLE tooling and an accurate, fast-acting Denison Index Table make it possible.

This 75-ton Denison hydraulic Multipress with six-station Index Table handles 22 swaging jobs for Mechanics Universal Joint Division, Borg-Warner Corporation.

For setup, the operator simply changes punches. The Denison Index Table, hydraulically interlocked with the Multipress ram, indexes from 10 to 70 times a minute . . . maintains limits of plus-or-minus two-thousandths.

This application—ring-swaging oil seals for universal-joint assemblies—shows what Multipress can do. Replacing a punch press, Multipress raised production 36 per cent . . . lowered labor costs 30 per cent.

Denison Multipress combines speed, accuracy and safety for swaging, testing, assembling and many more applications in the 1-to-75-ton pressure range. For bulletins, write to:

THE
DENISON ENGINEERING COMPANY
1244 Dublin Road • Columbus 16, Ohio

DENISON Hydr OIL ics



Precision gears in quantity—at competitive prices!

PERKINS GEAR ENGINEERING SERVICES extend from coast-to-coast. Hence, no matter where you are located, we will gladly—and promptly—furnish estimates on your requirements for custom-made gears, and consult with you on the possibility of obtaining a more economical and highly efficient source of supply for the precision gears you require.

We do not manufacture stock gears. But once your specifications are in our files, re-orders are filled promptly—*and delivered on time.* We are equipped to produce gears in any quantity, any type, any material, metallic or non-metallic.

Let us present our conception of a modern and *mutually* advantageous gear engineering service. No obligation of course.

YOU FURNISH THE SPECIFICATIONS, WE'LL PRODUCE THE GEARS!

PERKINS MAKES: helical gears, bevel gears, sprockets, ratchets, worm gears, spiral gears, spur gears with shaved or ground teeth, ground thread worms.

NOTE: The PERKINS PRECISION SPRING COILER is the latest development in the spring coiler field and eliminates entirely the use of arbors and long set up time. It is a complete self-sufficient machine and enables you to make the spring you want when you want it—in seconds. The coiler produces any type of spring, in any diameter and any pitch with this range: Wire sizes .005 to .125. Diameter, from 3/32" to 12" and larger. Size of the compact coiler is only 7½ x x 16". A POWER MODEL mounted on a welded steel console cabinet base is also available. Full information on request.

PERKINS
MACHINE & GEAR COMPANY
WEST SPRINGFIELD, MASSACHUSETTS

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Carpenter Steel Co., Reading, Pa.
Columbia Tool Steel Co., Lincoln Hwy. & State St., Chicago Heights, Ill.
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Vanadium Alloys Steel Co., Latrobe, Pa.
Wheelock-Lovejoy & Co., Inc., Cambridge, Mass.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

TOOL BITS, Special Alloy

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Kennametal, Inc., Latrobe, Pa.
Vanadium Alloys Steel Co., Latrobe, Pa.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

TOOL GRINDERS

See Grinding Machines for Sharpening, Turning and Planning Tools.

TOOL GRINDING ATTACHMENTS

Detroit Reamer & Tool Co., 2830 E. 7 Mile Rd., Detroit, Mich.

TOOL HOLDERS

Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Burg Tool Mfg. Co., 3743 Durango Ave., Los Angeles 34, Calif.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Eclipse Counterbore Co., 1600 Bonner Ave., Ferndale, Mich.
Michigan Tool Co., 7171 E. McNichols Rd. Detroit, Mich.
OK Tool Co., Milford, N. H.
Portage Double Quick Tool Co., 1063 Sweitzer Ave., Akron 11, Ohio.
R and L Tools, 1825 Bristol St., Philadelphia 40, Pa.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill. (Turret)
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

TOOLMAKERS' INSTRUMENTS

Ames, B. C., Co., Waltham 54, Mass.
Baptist Machine Co., Inc., 36 Ludlow St., Stamford, Conn.
Brown & Sharpe Mfg. Co., Providence, R. I.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

TOOL STEEL

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Columbia Tool Steel Co., Lincoln Hwy. & State St., Chicago Heights, Ill.
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Jos. T., & Son., Inc., 2558 W. 16th St., Chicago 18, Ill.
Vanadium Alloys Steel Co., Latrobe, Pa.

(*Continued on page* 400)

For more information on products advertised, use Inquiry Card, page 243

GENERAL ELECTRIC selects 11 MORE CLEVELAND PRESSES



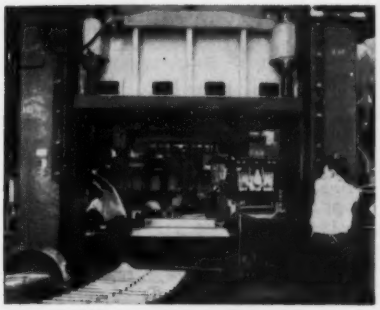
Photos courtesy General Electric Company.

Last year 15 new Cleveland Presses were installed at Appliance Park, Louisville, Kentucky, General Electric's new major appliance center. These presses produce parts for the famous General Electric ranges.

Now 11 more Cleveland Presses, equipped with the (patented) Cleveland Drum Type Clutch, are working in General Electric's Home Laundry Equipment Department.

Throughout industry, both operators and management have come to respect the dependable accuracy and ease of control designed into rugged Cleveland Presses. Production records indicate that the new Cleveland Clutch gives faster, more accurate control. Maintenance records show that this friction clutch requires only minor, easy-to-make adjustments.

You, too, can benefit by installing new Clevelands in your press production line. Let a Cleveland engineer help you select the exact Cleveland Press for utmost efficiency. Write or call today! A-9759







THE CLEVELAND PUNCH & SHEAR WORKS CO.

Established 1880

POWER PRESSES — FABRICATING TOOLS

E. 40th & St. Clair Avenue, Cleveland 14, Ohio

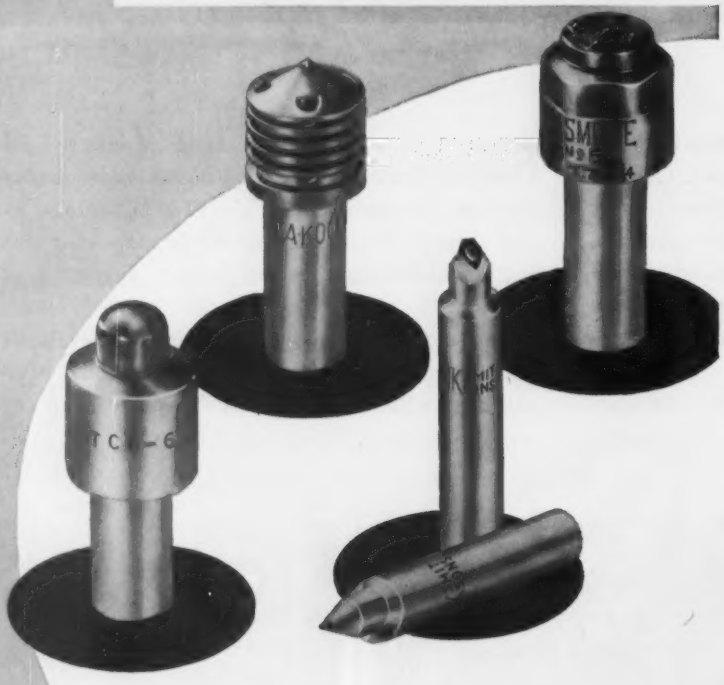
Offices at: NEW YORK • CHICAGO • DETROIT
PHILADELPHIA • E. LANSING • OXFORD, O.

CITY FOUNDRY DIVISION • SMALL TOOL DEPARTMENT

4 features that add up to 1 fact...

You can depend on JKS Diamond Tools

- Competent Selection of Diamonds
- Modern Plant with Modern Methods
- Qualified Field Representatives, Strategically Located
- Over 65 Years of Successful and Fair Dealing



Send for your copy of our Tool Catalog or perhaps you may wish to consult our engineering staff for assistance on *your* Diamond Tool problem.

2735

J. K. SMIT & SONS, INC.
Murray Hill, N. J.

TOOLS, Carbide-Tipped

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Colonial Broach Co., Detroit 13, Mich.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Kennametal, Inc., Latrobe, Pa.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Metal Carbides Corp., Youngstown, Ohio.
Newcomer Products, Latrobe, Pa.
OK Tool Co., Milford, N. H.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Union Twist Drill Co., Athol, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

TOOLS, Lathe, Shaper and Planer

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Halpern, Wm., Co., Inc., 100 Stevens Ave., Mt. Vernon, N. Y.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Kennametal, Inc., Latrobe, Pa.
OK Tool Co., Milford, N. H.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Super Tool Co., 21650 Hoover Road, Detroit 13, Mich.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland, Ohio.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

TRANSFER MACHINES, Automatic

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Colonial Broach Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

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General Electric Co., Schenectady, N. Y.

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Link-Belt Co., 2045 W. Huntington Park Ave., Philadelphia 40, Pa.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4.
Reliance Electric & Engrg. Co., 1047 Ivanhoe Rd., Cleveland 10, Ohio.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

TUBE FLANGING MACHINES

Grant Mfg. & Mch. Co., 90 Silliman St., Bridgeport 5, Conn.

TUBE FORMING AND WELDING MACHINES

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Yoder Co., 550 Walworth Ave., Cleveland.

TUBE MILLS

Abbey-Etna Co., 2422 Maplewood Ave., Toledo 10, Ohio.

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Mueller Brass Co., Port Huron 35, Mich.
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.

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Carpenter Steel Co., Reading, Pa.
National Tube Div. U. S. Steel Corp., 525 Wm. Penn Place, Pittsburgh, Pa.
Republic Steel Corp., Steel & Tubes Div., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Summerill Tubing Co., Div. Columbia Steel & Shafting Co., P. O. Box 1557, Pittsburgh, 30, Pa.
Timken Roller Bearing Co., Canton, Ohio.

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See Drills, Twist

UNIVERSAL JOINTS

Baush Machine Tool Co., 156 Wasson Ave., Springfield 7, Mass.
Boston Gear Works, 3200 Main St., North Quincy 71, Mass.
Gear Grinding Machine Co., 3901 Christopher St., Detroit 11, Mich.

VALVE CONTROLS

Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.
Philadelphia Gear Works (Motorized), Erie Ave. and G St., Philadelphia, Pa.

VALVES, Air

Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Hunt, C. B., & Son, Inc., 1911 E. Pershing St., Salem, Ohio.
Lehigh Foundries, Inc., 1500 Lehigh Dr.. Easton, Pa.
Rivett Lathe & Grinder Inc., Brighton, Boston 35, Mass.
Ross Operating Valve Co., 120 E. Golden Gate, Detroit, Mich.

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American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Baptist Machine Co., Inc., 36 Ludlow St., Stamford, Conn.
Barnes, John S., Corp., Rockford, Ill.
Denison Engrg. Co., 1160 Dublin St., Columbus 16, Ohio.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
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Logansports Machine Co., Inc., 810 Center Ave., Logansport, Ind.
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Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.

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Baptist Machine Co., Inc., 36 Ludlow St., Stamford, Conn.

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American Felt Co., Glenville, Conn.

VISES, Machine

Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Logansports Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Prioducto Mch. Co., 990 Housatonic Ave., Bridgeport, Conn.
Skinner Chuck Co., 344 Church St., New Britain, Conn.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend. Ind.
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U. S. Burke Machine Tool Div., Brotherton Rd. 17, Cincinnati 27, Ohio

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Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

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Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Skinner Chuck Co., 344 Church St., New Britain, Conn.
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Eaton Mfg. Co., Reliance Div.. 25 Charles Ave., S. E., Massillon, Ohio.

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Linde Air Products Co., Div. Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.

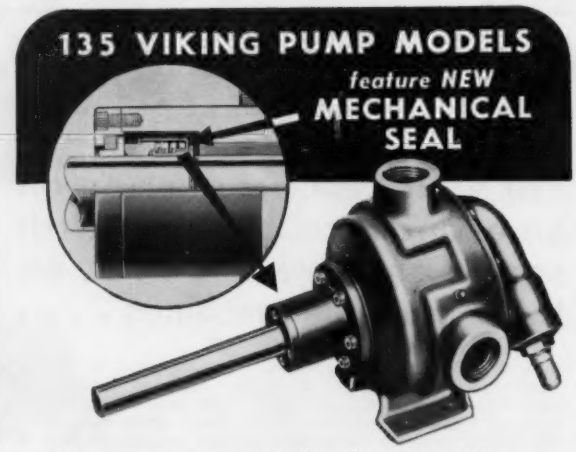
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Woods, A. C., & Co., Div. Kropp Forge Co., 1129 Harrison Ave., Rockford, Ill.

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Bethlehem Steel Co., Bethlehem, Pa.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
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Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.
Walker-Turner Div., Kearney & Trecker Corp., 900 North Ave., Plainfield, N. J.

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Cone-Drive Gear Div., Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Link-Belt Co., 2045 W. Huntington Park Ave. Philadelphia 40, Pa.
Philadelphia Gear Works, Erie Ave. and G St Philadelphia, Pa.

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Butterfield Div., Union Twist Drill Co., Derby Line, Vt.
Card, S. W., Mfg. Co., Div. Union Twist Drill Co., Mansfield, Mass.
Greenfield Tap & Die Corp., Greenfield, Mass.
Pratt & Whitney, West Hartford 1, Conn.

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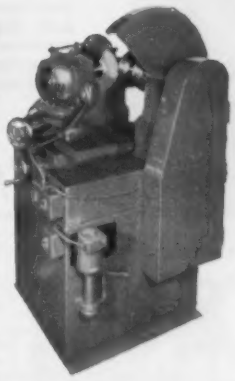
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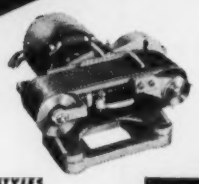
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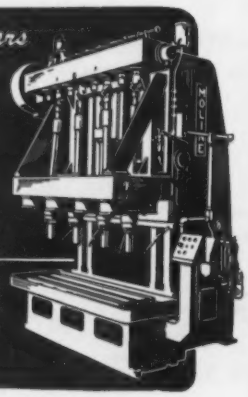
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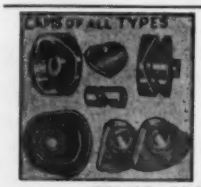
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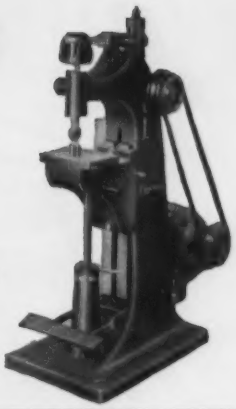
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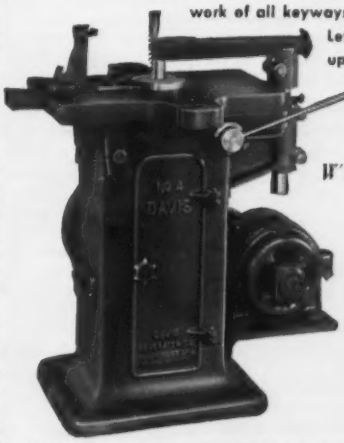
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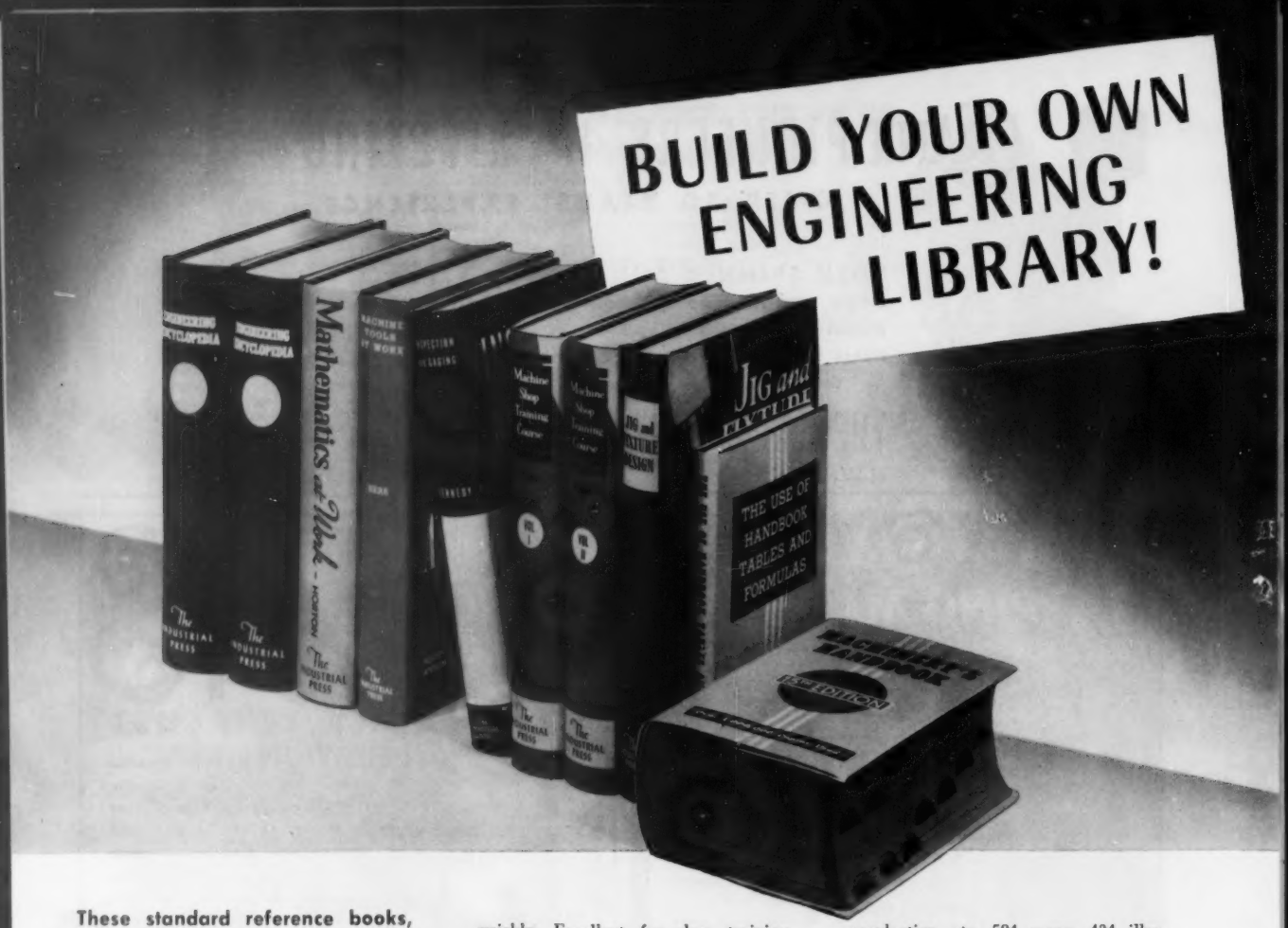
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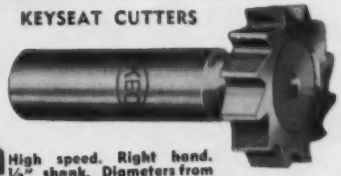
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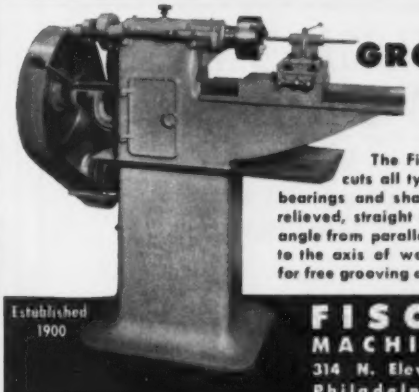


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GRINDERS, CYLINDRICAL, 14" x 36" Landis, type C, 1942,
GRINDERS, CYLINDRICAL, 16" x 36" Norton, 1943,
GRINDERS, CYLINDRICAL, 16" x 72" Norton, type C, 1945,
GRINDERS, CYLINDRICAL, 16"/40" x 96" Landis type B, 1941,
GRINDERS, CYL., UNIVERSAL, 12" x 36" Landis, hydraulic, 1947,
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LATHES, TURRET, No. H-5 Libby International, 1942,
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#548 ½" Cone	10,000	50
#00G Brown & Sharpe	6,250	30
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54" Sellers w/side Head	60,000	90
42" Bullard	42,000	159
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36" Bullard	36,000	99
24" Bullard	24,000	59
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15" Gleason Spiral Bevel Rougher	21,000	49
9" Gleason Spiral Bevel Generator	20,000	70
8" Gleason Spiral Bevel Generator	16,000	68
#3 Gleason Spiral Bevel Generator	6,700	60
624A3 Fellow Spur & Helical Shaper	16,000	130
#615 Fellows Shaper	11,000	70
#725 Fellows Shaper	8,000	70
#12-B Gleason St. Bevel Rougher	16,000	139
#12 Gleason St. Bevel Finisher	19,000	150
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23"x36" Norton	36,000	135
14"x36" Norton	28,310	115
10"x36" Norton	19,245	99
10"x18" Norton	19,000	79
4"x12" Landis	10,200	79
16"-26"x48" Cincinnati Univ.	17,000	75

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#2 Norton	6,155	78
Adrian Oliver	6,000	27
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15"x15"x72" Norton	19,000	110
12"x36" Diamond	13,000	53
8"x24" Doall	6,500	70
(B) 14"x40" Pratt & Whitney	16,000	119
6"x18" Norton	4,400	46
(C) #25A Heald 20" Chuck	14,500	119
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72-A-5 Heald	20,000	99
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45 T #630 Bliss H1 Prod	16,500	70
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6.2 Denver	15,000	75
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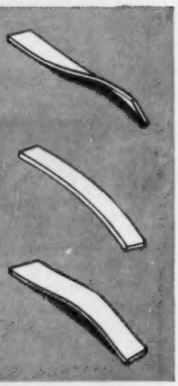
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TWIST Excessive bending during cutting is the major cause of twist in pieces sheared. There is a direct relation between bending and the rake or shear angle of the upper knife. A high rake bends a piece MORE than a low rake because a SHORTER section of the stock is under pressure during cutting.

CAMBER Departure of the edges of a strip from a straight line is called camber. An important factor in causing camber is high rake which tends to rotate a sheet during cutting.

BOW Bow is deformation in a direction perpendicular to the surface of a strip. Here again experience shows that low rake gives the best results.



WHEN CUTTING WITH STEELWELD SHEARS

MORE is required of a shear than the power to cut, to achieve precision shearing. A great deal depends on how the cut is made if parts cut are going to fit accurately without additional work.

For this reason rake, or knife shear angle has been made very low on all Steelweld Shears. This of course requires more driving power and consequently a larger driving motor and heavier construction throughout than would be necessary with a higher rake. But it minimizes twist, camber and bow in pieces cut.

Because of low rake and also because of the ease with which knife clearance is adjusted to suit every plate thickness, cuts made on Steelweld shears are unusually smooth, straight and true.



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STEELWELD PIVOTED BLADE SHEARS

For more information on products advertised, use Inquiry Card, page 243

ALPHABETICAL INDEX OF ADVERTISERS

A

Abrasive Machine Tool Co. 372-373
Allegheny Ludlum Steel Corp. 115
Allen, Alva F. 404
Amco Gage Co. 363
American Brass Co. 265
American Broach & Mch. Co. ..... Insert 87-102
American Chain & Cable 289-409
American Felt Co. 325
American Steel Foundries 145
American Tool Works Co. 129
Ames, B. C., Co. 374
Anderson Bros. Mfg Co. Insert 87-102
Armstrong-Blum Mfg. Co. 32
Armstrong Bros. Tool Co. 136B
Automatic Steel Products, Inc. 302
Avey Drilling Machine Co. 272
Axelson Manufacturing Co. 47

B

Baker Bros., Inc 331
Baldwin-Lima-Hamilton Corp. 140
Ball & Roller Bearing Co. 409
Baptist Machine Co. Inc. 364
Barber-Colman Co. Insert 87-102
Bardons & Oliver Inc. 52
Barnes Drill Co. ..... Insert 87-102
Barnes, John S., Co. Insert 87-102
Baush Machine Tool Co. 309

Bethlehem Steel Co. 105-116
Bilgram Gear & Mch. Wks. 401
Birdsboro Steel Foundry & Machine Co. 381
Black & Decker Mfg. Co. 393
Blanchard Machine Co. 48
Bliss, E. W. Co. 73
Boston Gear Works 359
Braun Gear Co. 409
Brown & Sharpe Mfg. Co. Insert 233-234
Bryant Chucking Grinder Co. 266-267-353
Buck Tool Co. 339
Buhr Machine Tool Co. 241
Bullard Co. ..... Insert 38-39
Butterfield Div., Union Twist Drill Co. 303

C

Cameron Iron Wks., Inc. 329
Campbell Machine Div. American Chain & Cable 289
Carboloy Dept. of General Electric Co. 295
Carborundum Co. Insert 273-274
Card, S. W., Mfg. Co. 143
Carlton Machine Tool Co. 138-139
Carpenter Steel Co. 106
Challenge Mchy. Co. 330
Chambersburg Engrg. Co. 311
Chicago-Latrobe Twist Drill Wks. 334
Chicago Pneumatic Tool Co. 242
Cincinnati Bickford Tool Co. 237
Cincinnati Gear Co. 390
Cincinnati Lathe & Tool Co. 54-55
Cincinnati Milling Machine Co. 6-7
Cincinnati Milling Machine Co., Hydroform Div. 79
Cincinnati Milling Products Div., Cincinnati Milling Machine Co. 27-122-123
Cincinnati Shaper Co. 44-45
Cities Service Oil Co. 355
Clark Controller Co. Insert bet. 282-285
Classified Advts. 410-411
Clearing Machine Corp. Insert bet. 292-295
Cleveland Crane & Engrg. Co. 412
Cleveland Instrument Co. 340
Cleveland Punch & Shear Wks. Co. 399
Cleveland Tapping Machine Co. 302
Cleveland Twist Drill Co. Insert 136A
Colonial Broach Co. 128
Columbia Div., The Lodge & Shipley Co. 282
Columbia Tool Steel Co. 392
Columbus Die-Tool & Mch. Co. 371
Cone Automatic Mch. Co., Inc. 141
Consolidated Machine Tool Corp. 30-31
Cross Company Insert bet. 48-51
Crucible Steel Co. of America 103-113
Cumberland Steel Co. 114

D

Danly Mch. Specialties, Inc. 137-388-389
Davis Keyseater Co. 405
Dearborn Gage Co. 356
DeLaval Separator Co. 337
Denison Engineering Co. 397
Detroit Reamer & Tool Co. 323
Detroit Tap & Tool Co. 291
Diefendorf Gear Corp. 409
DoAll Company 385
Dreis & Krump Mfg. Co. 405
Dykem Co. 407

E

Eastern Mch. Screw Corp. 413
Eastern Machinery Co. 410
Eastman Kodak Co. 307
Eaton Manufacturing Co., Reliance Div. 317
Edlund Machinery Co. 404
Eisler Engineering Co., Inc. 404
Ekstrom-Carlson & Co. Insert 87-102
Ellstrom Standards Div. Dearborn Gage Co. 356
Errington Mechanical Laboratory, Inc. 363
Etteo Tool Co., Inc. 37
Ex-Cell-O Corporation 256-263

F

Fairfield Manufacturing Co. 322
Falk Machinery Co. 410
Farrel-Birmingham Co., Inc. 71
Farval Corp. 53
Federal Machine & Welder Co. 386
Federal Press Co. 68
Federal Products Corp. 126-127
Fellows Gear Shaper Co. 4-5
Firth Sterling, Inc. 297
Fischer Machine Co. 407
Foote-Burt Company 26
Formsprag Co. 343
Fosdick Machine Tool Co. 268-269
Fulmer, Allen C., Co. 358

G

Gairing Tool Co. 352
Gallmeyer & Livingston Co. 396
Gardner Machine Co. 25-77
Garlock Packing Co. 378
General Electric Co. (Insert 83-84) 333
Gerotor May Corp. 130
Giddings & Lewis Machine Tool Co. 18-19
Gisholt Machine Co. (Insert bet. 32-37)
Gleason Works ..... Front Cover
Gorham Tool Co. 308
Gorton, George, Mch. Co. 300
Goss & DeLeeuw Mch. Co. 298
Grant Mfg. & Machine Co. 405
Gray, G. A., Co. 121
Greenlee Bros. & Co. Insert 87-102
Greenfield Tap & Die Corp. Insert 85
Grob Brothers 405

H

Hanchett Magna-Lock Corp. 306
Hannifin Corporation 366
Hardinge Brothers, Inc. 150
Haynes Stellite Co. Div., Union Carbide & Carbon Corp. 104
Heald Machine Co. Inside Front Cover
Hill Acme Co. 132
Howell Electric Motors Co. 361
Hyatt Bearings Div., General Motors Corp. 305
Hydraulic Press Mfg. Co. Insert bet. 58-61

I

Industrial Filtration Co. 279
Industrial Press 367-391-406
Ingersoll Milling Machine Co. ..... Insert 87-102
Innocenti Corp. 281
Iroquois Corporation 403

J

Jacobs Manufacturing Co. 74-75
Johnson Bronze Co. 380
Jones & Lamson Machine Co. 42-144-335

K

Kaufman Mfg. Co. 405
Kaukauna Machine Corp. 347
Kearney & Trecker Corp. 20-21
Keller Tool Co. 288
Keo Cutters 407
Kennametal, Inc. 384
King Mch. Tool Div. American Steel Fdries. 145
Kingsbury Mch. Tool Corp. 64-65

L

L & J Press Corp. 360
Landis Machine Co. 2-3
Landis Tool Co. 10-11
Lapointe Machine Tool Co. 350-351
Le Blond, R. K., Machine Tool Co. 28-29
Lehigh Foundries, Inc. 368
Leland-Gifford Co. 56
Lincoln Electric Co. 70
Linde Air Products Co., Div. Union Carbide and Carbon Corp. 40
Link-Belt Co. 24
Lucas Machine Div., The New Britain Mach. Co. Inside Back Cover
Luers, J. Milton 407

M

Madison-Kipp Corp. 62
Materials Section 103-118
Mattison Machine Works Insert 87-102
Metal Carbides Corp. 402
Michigan Tool Co. Insert bet. 128-129
Micron Gear Mfg. Co. 394
Miles Machinery Co. 410
Millers Falls Co. 332
Millholland, W. K., Machinery Co. 338
Mitts & Merrill 404
Modern Mch. Tool Co. 348
Moline Tool Co. 404
Monarch Machine Tool Co. Insert 119
Moore Special Tool Co., Inc. 72
Morey Machinery Co., Inc. 410
Morgan Engineering Co. 408
Morris Machine Tool Co. 327
Motch & Merryweather Mchry. Co. 84-294
Mummert-Dixon Co. 413

N

National Acme Co. 41-51
National Automatic Tool Co. Inc. 66-67
National Broach & Mch. Co. 136
National Forge & Ordnance Co. 108
National Tool Co. 285
National Tube Div., U. S. Steel Corp. 349
National Twist Drill & Tool Co. 17
New Britain Mch. Co., The Inside Back Cover
New Departure Div. General Motors 253
New Jersey Gear & Mfg. Co. 408
New Jersey Zinc Co. 112



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ALPHABETICAL INDEX OF ADVERTISERS

Niagara Machine & Tool Works 80-81
Nichols-Morris Corp. 321
Norgren, C. A., Co. 261
Norton Company 14-15
(Insert bet 144-145)

O

O K Tool Co., Inc. 313-410
Oakite Products, Inc. 107
Ohio Crankshaft Co. 57
Oilgear Co. 369
Oliver Instrument Co. 310
Olsen, Tinius Testing Machine Co. 382
Osborn Mfg. Co. 286
Ottemiller, William H., Co. 407

P

Pangborn Corporation 414
Parker-Kalon, Div. General American Transportation Corp. 375
Perkins Mch. & Gear Co. 398
Philadelphia Gear Wks., Inc. 43
Pope Machinery Corp. 63
Potter & Johnston Co. 133
Pratt & Whitney Div. Niles Bement Pond Co. 125
Procunier Safety Chuck Co. 354

R

R and L Tools 147
Rehnberg-Jacobson Mfg. Co. Insert 87-102
Reid Bros. Co., Inc. 376
Reliance Div. Eaton Mfg. Co. 317
Reliance Electric & Engineering Co. 341
Republic Steel Corp. 118
Revere Copper & Brass, Inc. 259
Richard Bros. Punch Div. Allied Products Corp. 377
Rockford Clutch Div. of Borg-Warner 344
Rockford Machine Tool Co. .....Insert 87-102
Rockwell Manufacturing Co. (Drill Unit Div.) 299
Rockwell Mfg. Co. Delta Power Tool Div. 301
Rogers Machine Works 387
Rollway Bearing Co., Inc. 276
Ross Operating Valve Co. 247
Rowbottom Machine Co. 401
Ruthman Machinery Co. 403
Russell, Holbrook & Henderson, Inc. 131
Ryerson, Joseph T., & Sons, Inc. 152

S

Sales Service Machine Tool Co. 278
Schrader's, A., Son 315
Scherr, Geo., Inc. 370
Seneca Falls Mch. Co. 134-135
Shear Speed Chemical Products, Div. Michigan Tool Co. 61
Sheffield Corp. 248
Sheldon Machine Co., Inc. 346
Shore Instrument & Mfg. Co., Inc. 409
Sier-Bath Gear & Pump Co., Inc. 371
Sinclair Refining Co. 280
Smit, J. K., & Sons, Inc. 400
Simonds Saw & Steel Co. 379
Snow Mfg. Co. 275
South Bend Lathe Works 292
Snyder Tool & Engrg. Co. 251
Springfield Machine Tool Co. 383
Stahl Gear & Machine Co. 408
Standard Gage Co., Inc. 86
Standard Oil Co. 270-271
Standard Pressed Steel Co. 46
Starrett, The L. S., Co. 254
Sun Oil Co. 239
Sundstrand Machine Tool Co. ..... Insert 87-102
Super Tool Co. 324
Supreme Products, Inc. 314
Sweet's Catalog Service 316

T

Taft-Peirce Mfg. Co. 78-82
Texas Company 148
Timken Roller Bearing Co. Back Cover
Timken Roller Bearing Co. (Steel & Tube Div.) 109
Tomkins-Johnson Co. 357
Torrington Co. 58
Turner Bros., Inc. 124
Tuthill Pump Co. 304
Twin Disc Clutch Co. 320

U

U. S. Steel Supply Div., United States Steel Corp. 117
U. S. Tool Company, Inc. 12-13
Union Carbide & Carbon Corp., Haynes Stellite Co. 104
Union Carbide & Carbon Corp., Linde Air Products Co. Div. 40
Union Drawn Steel Div., Republic Steel Corp. 118
Union Twist Drill Co. 287
United States Drill Head Co. 290
United States Steel Corp. 110-111-349
Universal Engineering Co. 345
Used Machinery 410-411

V

Van Keuren Co. 146
Van Norman Co. 8-9
Verson Allsteel Press Co. 395
Vickers Incorporated 365
Viking Pump Co. 402
Vinco Corp. 312

W

Waldes Kohinoor, Inc. 277
Walker, O. S., Co., Inc. 336
Walker-Turner Div., Kearney & Trecker Corp. Insert bet. 68-71
Walls Sales Corp. 404
Waltham Machine Works 404
Warner & Swasey Co. 22-23
Wesson Company 319
Wesson Metal Corp. 318
Wicaco Machine Corp. 342
Wiedemann Machine Co. 142
Williams, J. H. & Co. 296
Williamson Gear & Mch. Co. 408
Wilson Mechanical Instrument Division, American Chain & Cable 409
Winter Brothers Co. 16
Winzeler Mfg. & Tool Co. 407

Y

Yoder Company 76

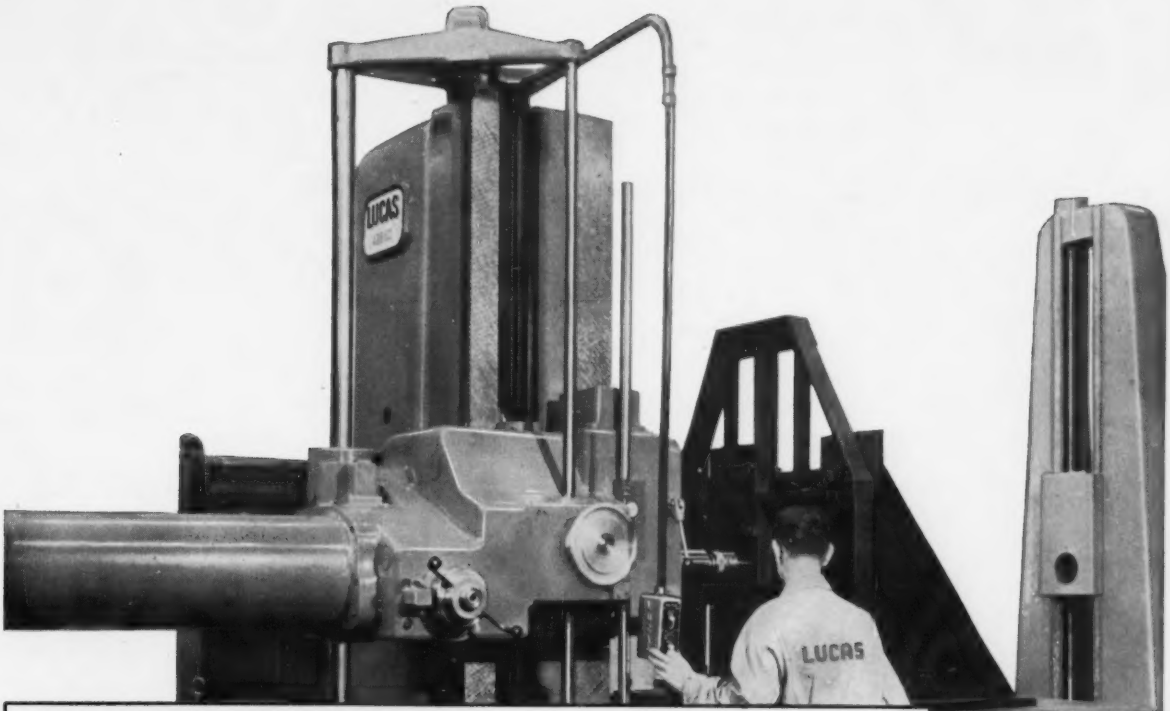
Z

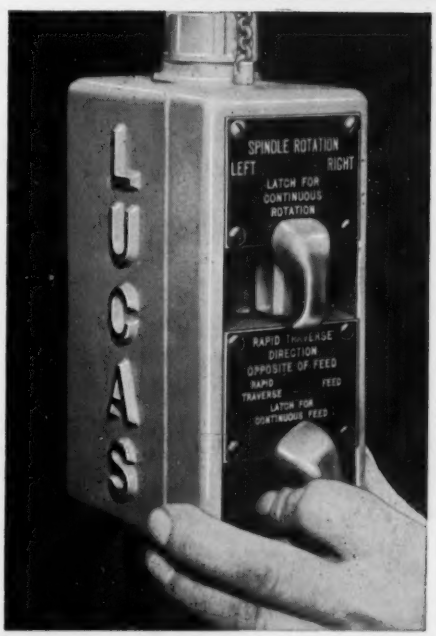
Zagar Tool, Inc. 362

CLASSIFIED SECTION
See page 410-411



For more information on products advertised, use Inquiry Card, page 243





Here is the new, lightweight, swing-about pendant control on the Lucas horizontal boring machine. This flexible control places at the operator's finger tips, over the entire working area about the machine, START, STOP, JOG (forward and reverse) of the spindle rotation, and START, STOP, INCH and RAPID TRAVERSE of all unit motions.

Two smooth operating switch levers in this small-dimension pendant do the work of ten control buttons. The position of the levers gives quick visual indication of engagement and direction. One of many features that is keeping Lucas out in front among horizontal boring, drilling and milling machines.

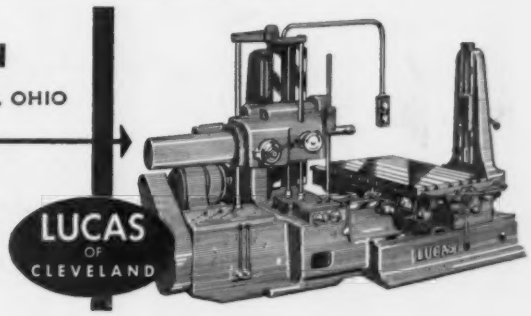
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Lucas Horizontal Boring, Drilling and Milling Machines

Our general catalog is filed in the Sweet's Machine Tool Catalog File.



"Old reliable" 21 in. sliding head floor drill stays accurate *with spindle on TIMKEN® bearings*

THE long-lasting precision of this Cincinnati 21″ sliding head floor drill has earned it the nickname "Old Reliable". One reason for this precision: the spindle is mounted on Timken® tapered roller bearings which are supported in an accurately ground and graduated quill. Two tapered roller bearings support the quill and two support the spindle pulley.

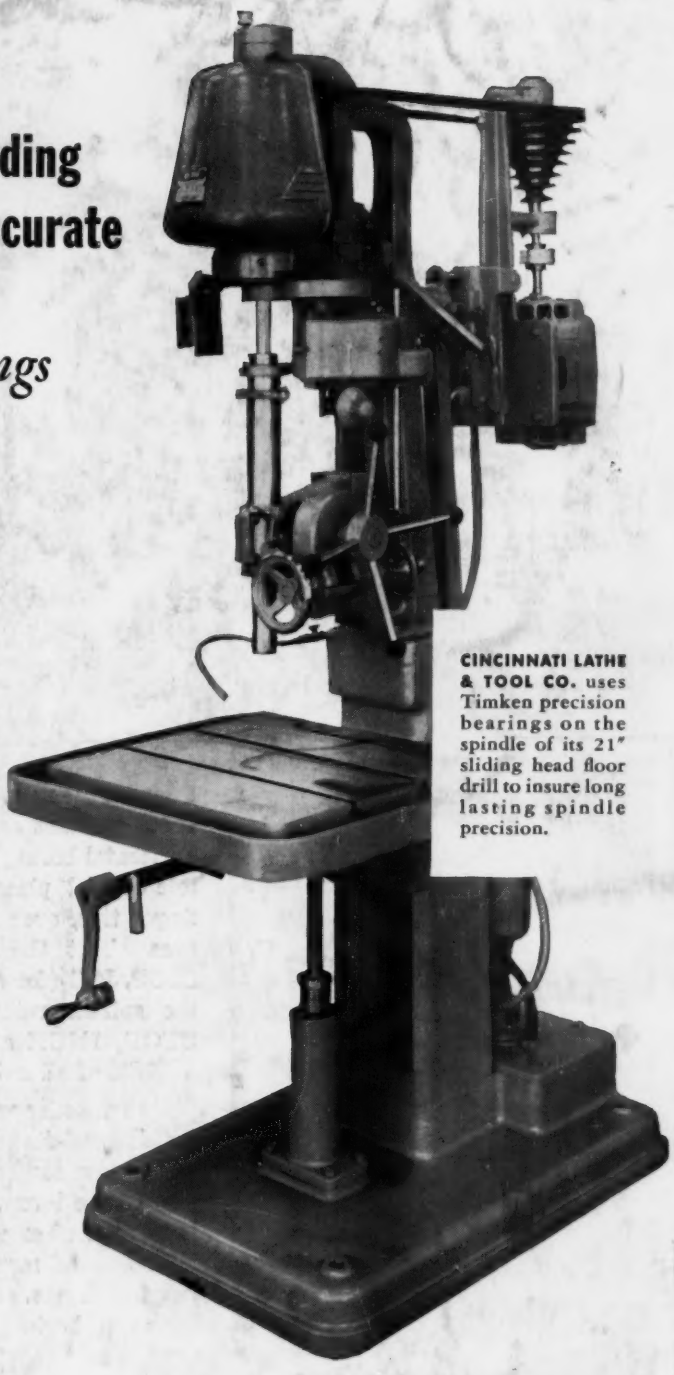
Timken precision bearings are especially designed for spindle applications. Run-out tolerances can be held to a maximum of 75 millionths of an inch. Due to their tapered construction, Timken bearings take both radial and thrust loads in any combinations, hold spindle rigid, permit pre-loading to any desired degree to prevent chatter.

Because of line contact between rollers and races, Timken bearings provide adequate capacity for any tool load. And spindle accuracy can always be maintained because Timken precision bearings are adjustable.

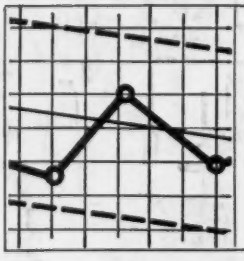
Timken bearings have contributed to the development of precision machine tools for over 25 years. To get longer life with minimum maintenance, buy or build machine tools that are Timken bearing equipped. Always look for the trade-mark "Timken" stamped on every bearing. The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable address: "TIMROSCO".

TIMKEN BEARING EQUIPPED

This symbol on a product means its bearings are the best.

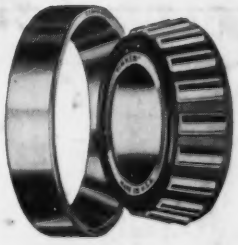


CINCINNATI LATHE & TOOL CO. uses Timken precision bearings on the spindle of its 21″ sliding head floor drill to insure long lasting spindle precision.



STATISTICAL QUALITY CONTROL

To insure uniform high quality and closer tolerances, the Timken Company uses statistical quality control. With it, tolerance deviations are plotted graphically. It's one of industry's newest, most scientific methods of improving product uniformity.



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